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Final Report

IMPACT OF THE LOCATION OF NEW SCHOOLS ON TRANSPORTATION INFRASTRUCTURE AND FINANCE

By

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Abstract

Public school planning and land use planning have become increasingly separated fields over the last 40 years. The result is a often disjointed growth pattern where new schools are built on the urban fringe and act as a magnet for new development that often goes against desired development patterns. Previous research on school locations, development patterns and school finance has focused on institutional barriers to cooperation and strategies to help local governments cooperate better with local land use planners. To date, there has been no significant research that attempts to quantify the relationship between school location, development patterns and the transportation infrastructure necessary to serve new development, and the impact of school sales tax initiatives on local transportation strategies.

This research shows that there is a relationship between school location and new development. Four counties in Georgia were selected as case studies and analyzed with a Geographic Information System (GIS) to determine the significance of the relationship between the two. Counties were selected based on their character (urban, suburban, exurban, rural) and analyzed separately. An elementary school and high school were analyzed for each county. In addition, interviews with school facility planners were conducted to further define what institutional barriers prevent cooperation among local land use planners and school planners. It was found that there is a wide range of levels of cooperation between school planners and local planners. Some school districts had a formalized communication process with local planners, some had an ad-hoc communication process, and others had no process at all. Recommendations are made on ways to improve the cooperation between these two professional fields.

This report also examines the link between education and transportation sales tax funding. This study analyzed SPLOST referenda results in Georgia to better understand the propensity of voters to approve transportation and education sales taxes, and the implications of the approval of one referendum on voter approval of another. Since 1998, sales tax referenda have generally seen yearly pass rates greater than 80%. After the introduction of education SPLOSTs in 1997, the yearly number of non-education sales tax referenda on the ballot in Georgia dropped from around 38 per year to around 31 per year. However, the pass rates for non-education referenda went from 83.4% in 1985 to 1997 to 93% in the period from 1998 to 2009. In analyzing the impacts of education and transportation referenda on one another, there are indications that there is some relationship between the two, but based on the current analysis the passage of either does not seem to negatively affect passage of the other.

Key Words: Transportation finance, schools and urban development, sales tax, transportation policy

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LIST OF SYMBOLS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
AYB	Actual Year Built
CBD	Central Business District
CEFPI	Council of Educational Facility Planners International
CFCC	Census Feature Class Code
EPA	United States Environmental Protection Agency
ESPLOST	Educational Special Purpose Local Option Sales Tax
EYB	Effective Year Built
GaDOE	Georgia Department of Education
GDOT	Georgia Department of Transportation
GIS	Geographic Information System
GSBA	Georgia School Boards Association
IU	Instructional Unit (classroom)
LOST	Local Option Sales Tax
MOU	Memorandum of Understanding
mph	Miles Per Hour
PFA	Priority Funding Area
SPLOST	Special Purpose Local Option Sales Tax

Chapter 1: INTRODUCTION

1.1 Introduction

Over the past 40 years, school planning and land use planning have become separated fields due to a complex school planning environment that must take into account changing student enrollments, equity, and complicated facility funding sources. In high growth states, school facility planners are building multiple new facilities each year and sometimes build in areas just beyond the development frontier, primarily due to cost and land availability constraints. This can cause these areas to become more attractive to developers and result in transportation agencies filling the gap in infrastructure to serve the new development.

While some states have recognized this issue and implemented mandatory statewide planning initiatives to require school districts and county governments to work together, Georgia has not yet done so. In many cases, county planning staff and school planning staff have no formal communication and are forced to take reactive measures rather than plan cooperatively. Ultimately school districts and county government are separate entities, chartered by the state constitution, and can operate autonomously. However, uncoordinated actions do not benefit the community. Figure 1.1 illustrates the current institutional framework viewed from the taxpayer's perspective.

School quality has also been shown to be an important criterion for home buying and residential choice [1]. Often, a new school is perceived as higher quality simply because it is new [2]. This often causes homebuyers to view those places where new schools have been built as having more desirable qualities than those with older schools. Due to state policies that provide a higher funding match for new construction, many school districts have a better return

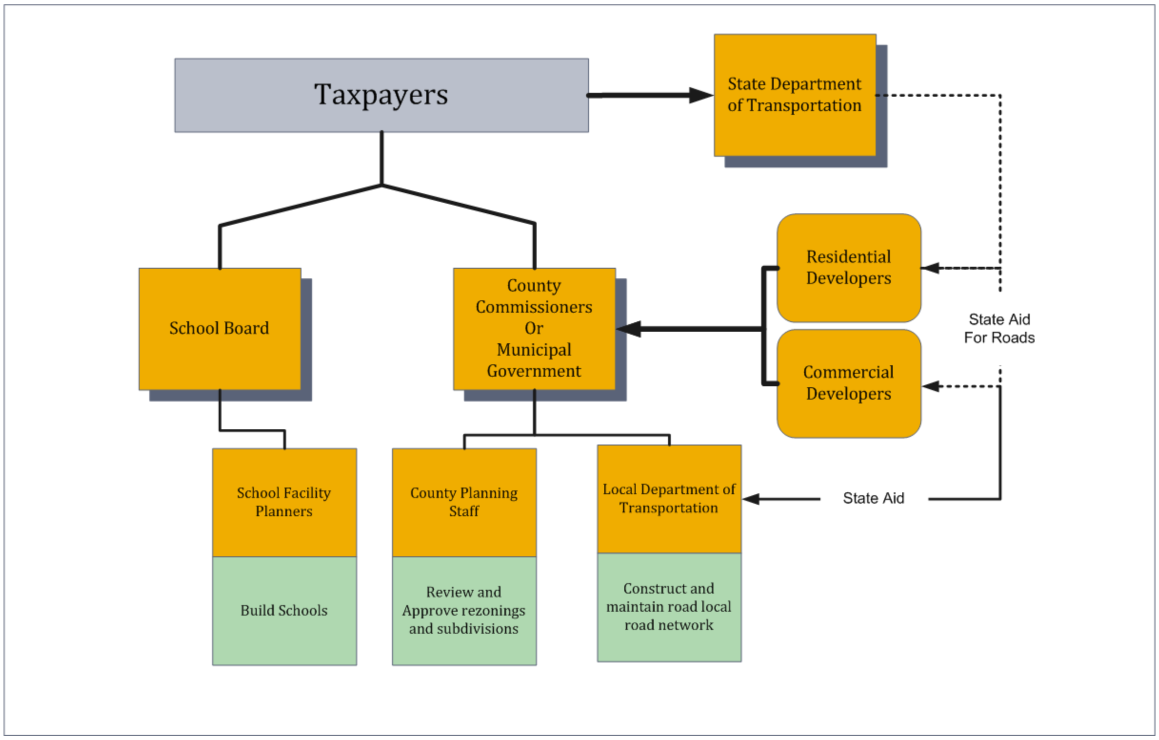


Figure 1.1 – Institutional Relationships Among Schools, State and Local Transportation Agencies

on investment for building new schools rather than renovating existing schools [3]. Some have blamed this funding policy for creating a bias towards new construction on greenfield sites, which results in increased sprawl development and inefficient use of existing public infrastructure [4].

This research has three primary objectives: 1) quantify the relationship between school site decisions and resulting development in Georgia, 2) identify the institutional barriers to cooperative school site planning, and 3) examine the funding relationship between school capital funding and transportation funding in Georgia as evidenced through local sales tax initiatives (Special Purpose Local Option Sales Taxes or SPLOSTs).

1.2 Methodology Overview

Four school districts having different developmental characteristics---schools in mature urban, mature suburban, developing exurban, and rural settings---were selected to analyze the relationship between development patterns and school site selection. Within these four districts, an elementary school and high school were selected for spatial analysis, resulting in a total of eight schools selected for study. Land use parcels were analyzed for new development between 1990 and 2007. Parcels were assigned a travel-time from the school site and analyzed based on travel distance from the school. Pre-construction growth rates were compared to post-construction growth rates to determine if growth occurred more rapidly after the school was built.

To identify institutional barriers between school planning and local planning, interviews were conducted with school planners, school board members, and statewide facility officials from the Georgia Department of Education (GaDOE) and the Georgia School Boards Association (GSBA). Interviews were summarized and strategic objectives were suggested to improve communication and collaboration between school districts and local governments.

The analysis of the impact of education sales tax initiatives on transportation sales tax initiatives used data on Special Purpose Local Option Sales Tax (SPLOST) referenda collected from the Georgia Secretary of State's Office (http://sos.georgia.gov/cgi-bin/SalesTaxElectionsIndex.asp). The data included 493 sales tax referenda held between 1985 and 1997 (representing the period during which only the general purpose local options sales tax (LOST) and non-school capital SPLOSTs were active) and 721 sales tax referenda for 159 Georgia counties introduced between 1998 and 2009 (representing the period during which all SPLOSTs were active). The primary focus of this paper was on analyzing the period when all

SPLOSTs were active. Among the 721 sales tax referenda introduced from 1998 to 2009, 678 referenda passed and 43 failed. This data was combined with other county-level variables to examine the relationship between education and transportation SPLOST referenda.

The relationship between the election results and the characteristics of counties were also examined using correlation analysis. The 721 election results were converted into county-level data, creating a 159 (county) by 138 (variables) matrix. The election results were analyzed in two different ways. First, the aggregate number of adoptions (and rejections) by purpose of the referenda was calculated for each county. These variables measured how often each county used SPLOSTs for financing its capital projects. Second, the average percentage of voters who approved (and rejected) referenda by purpose of the referenda was calculated for each county. Regardless of election results (pass or not), these variables measured how much voters were willing to support or reject the referenda.

1.3 Report Organization

The remainder of this report is organized into the following sections:

- **Chapter 2: Literature Review.** This chapter contains a summary of literature regarding the history of school planning, educational literature on school planning, and requirements specific to Georgia with regard to school facility planning.
- **Chapter 3: Data Collection and Preparation.** This chapter describes the data collection effort and the processes that were followed to prepare the data for analysis. The interview process is also described in detail. This chapter focuses on the first two research questions, that is, the relationship between school decisions and development

and the institutional challenges in connecting education and transportation planning. The finance analysis is found in chapter 6.

- **Chapter 4: Methodology and Analysis.** This chapter describes the specific statistical methods used for the analysis and the rationale behind the methods utilized.
- **Chapter 5: Discussion and Results.** This chapter includes a detailed description of the analysis and an interpretation of the results. Interview results are also summarized and analyzed.
- **Chapter 6:** This chapter examines the relationship between education and transportation SPLOSTs. What has been the record in passage of these initiatives? To what extent does the passage of one type of SPLOST affect the likelihood of the other passing?
- **Chapter 7: Recommendations and Conclusion.** The final chapter presents conclusions and recommendations based on the analysis of the data.

Chapter 2: LITERATURE REVIEW ON SCHOOL SITE SELECTION

This chapter summarizes the literature on school planning and site selection. Beginning with a history of school planning and land use planning, this review seeks to understand the theory of urban development patterns and residential choice. An extensive body of literature on urban location theory has examined why households choose to locate in certain areas of a metropolitan region. The literature has also shown a relationship between smaller schools and student performance. Although there has been a move since the 1950s to consolidate school districts and build larger schools, research has shown that student performance and social development improves when school enrollment is smaller [5].

Finally, it is necessary to look at Georgia's site requirements for school districts. Although school districts are autonomous governing bodies, the Georgia Department of Education has site requirements for any state-funded school building. These requirements seek to protect the health and safety of Georgia's students.

2.1 Brief History of School Planning

School planning and land use planning historically have been linked through a recognition that public schools and communities have interactive roles. However, school planning and local land uses planning today are independent professional fields. Although schools play a large role in the way cities and counties develop, school site planning and land use planning have become very much separate activities. Forty years ago this was not the case. School planning and local land use plans were developed simultaneously, often by the community planner in the municipal or county government. The community planner knew the details of how development would impact the school district and how to place development so that it would not adversely impact schools that did not have the capacity for new students. When housing developments were approved, the schools were made aware and often asked for input before subdivision approvals were granted. When new schools were needed, a developer would usually donate a small, walkable site that could also double as a neighborhood playground [6].

Everything changed after the United States Supreme Court's 1954 *Brown v. Board of Education* decision. School districts, not wanting to face the possibility of lawsuits and judges' desegregation orders, hired specialized planners to implement redistricting so that schools would be more integrated. This would prevent mandatory busing, but at the same time split up neighborhood schools. A 1973 Gallup poll revealed that a majority of blacks and whites favored redistricting, but only nine percent of blacks and four percent of whites favored busing children out of their own neighborhoods [7]. Suburban exodus was exacerbated in the 1974 Supreme Court *Milliken* v. *Bradley* [8] decision, which held that busing could not cross municipal boundaries. White middle-class families reasoned that to avoid the highly unpopular busing programs, they could move to the suburbs.

In the 1970s the federal government began to offer federal funding for capital improvements to schools that met desegregation compliance standards. School districts needed the funds to build facilities that were equivalent no matter who attended. To be successful in these federal programs, school districts needed specialized planners who understood and could implement the federal requirements.

At the same time, in most urban areas of the country, the 1960s and 1970s were times when rapid suburbanization occurred for reasons other than desegregation. The sprawled nature of this development pattern was not conducive to the neighborhood school model that had existed for much of the urban history of the U.S. The suburban school model became one of campus-like settings often requiring large parking lots to handle parking demand for students that attended the schools. Because of a level of specialization needed for this type of school planning, by the 1970s, the professional school planning community had become much more focused on the immediate needs of the school district, while local planners continued to focus on all other aspects of the community [9].

2.2 Schools and Residential Location

Traditional residential location models typically view the work trip as the most important transportation trip. However, research shows that households with children comprise a significant portion of the morning peak hour traffic. So, although the school trip may not be a big consideration on a daily basis, the traffic impact during congested hours can be significant. One study in California estimated that there was a 30% increase in vehicles on the road during the school year between the hours of 7:15 A.M. and 8:15 A.M [10]. The 2007 National Household Transportation Survey found that between 7 and 11% of non-work trips during the morning peak were trips to school [11]. This study did not take into account a trip chain that included a school as an intermediate stop, for example, a parent dropping a child off at school is not included in this statistic. Thus, the impact of school traffic on the roadway network could have been underestimated in this study. Clearly, school trips are significant and should be considered in the framework of regional transportation planning.

Recently, models have been developed that more fully consider the impact of schools on residential location. Specifically, Hanushek and Yilmaz [12] have developed a model that incorporates the tenets of community choice models and also takes into consideration commuting costs, school quality, and land rents. Their model also examines the polycentric city theme, where there are multiple employment centers, as found in many United States cities today. Their conclusions were that property taxes served as a surrogate "fee" for public education and location. Individuals who value public education locate in districts that have high quality public education (and taxes). Individuals that do not place a high priority on public education locate in places where property taxes are less, and where public education is not as strongly emphasized.

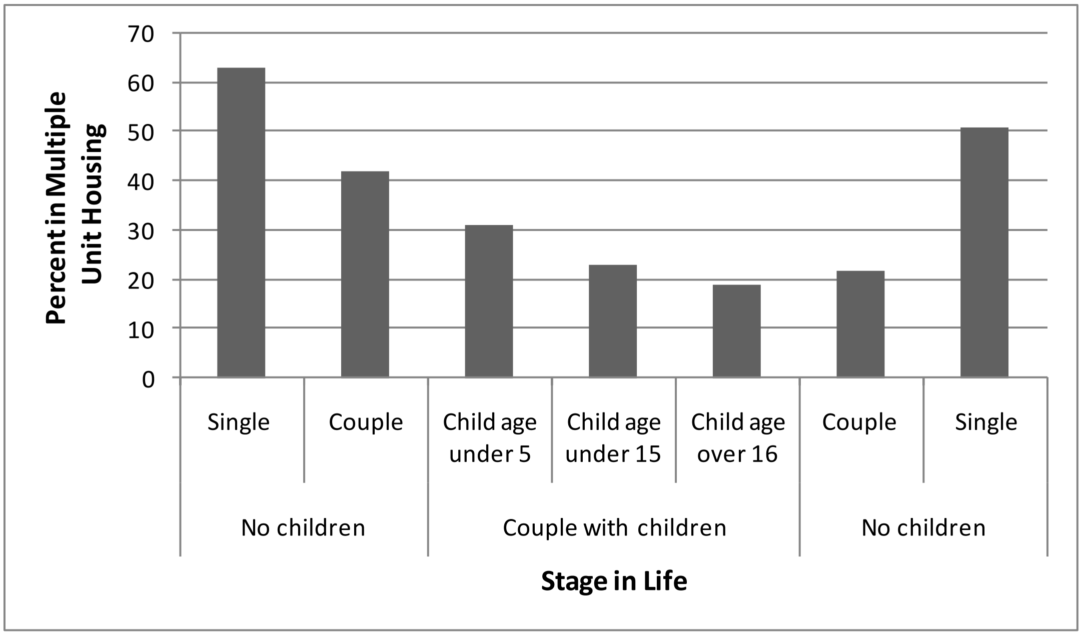
A long accepted tenet of real estate is that local schools have a significant impact on property values. A quality school system has been shown to be linked to property values. For example, in Clayton County, Georgia when the school district lost its accreditation, 30% of properties in the county lost value [13]. Studies have also shown that high performing schools can boost home values by up to 10 percent or more [14]. Developers desire sites within a catchment area of a good school as a marketing tool for their development. Many times developers will take into consideration school quality when deciding where to invest.

A study of schools in Michigan showed that schools built on the edge of the community were strongly correlated with the conversion of open land near the school. Furthermore, the study found that "the more extensively a school district engaged its citizens and the more intensively it studied existing facilities, the more frequently the district decided to either renovate existing buildings or construct new facilities near town centers" [15]. This finding speaks not only to the importance of the impact of school sites on residential development, but also to the value in public participation in the school planning process.

Residential choices are influenced by a variety of variables for different types of households. As noted in *Why Families Move*, small households without children are less likely to consider schools in their choice of dwelling (except for the consideration of property value retention). Larger households with school-aged children do consider this an important factor [16]. With regard to school considerations, this study of families in the United States found that when asked about existing housing, 22% of households complained about living space while only 6% complained about schools in their neighborhood. While this may seem to indicate that households do not consider schools as a key issue, this particular subset only looked at households that were *dissatisfied* with their current housing situation, so it is possible that households that were satisfied with their housing situation chose their residential location with schools in mind and were content with their choice.

An important consideration in looking at the impact of schools on travel and development patterns is understanding why families with school-aged children move. Research has shown that families without children choose multi-family housing much more frequently than those with children over the age of five. Preference for higher density housing has been shown to be a function of age and stage in the life cycle [17]. Figure 2.1 shows the relationship between stage in life and choice of multi-family housing (usually located in denser environments). By the time the youngest child is over five years old, the percentage of households living in multi-family housing decreased to 20 percent. The percentages decrease further once the family has children in their teenage years.

Another study from the real estate literature concludes that households are not so much looking for quality education, but for similar peer groups. David Brasington shows through regression and data from modeling that "parents do not choose schooling based on which school districts are best able to improve students' academic achievement; instead they appear to choose school systems based on peer group effects, valuing the type of children who attend the school district" [18]. This shows consistency with a model of households choosing to "self select" based on consumer preferences, which are driven by socio-demographic characteristics.



Source: TCRP Report 123 [19]

Figure 2.1. Life-Cycle Stages and Choice of Multi-Family Housing

School size also plays a large role in the location of schools. During the last fifty years, an average size of the school site has gradually increased, mostly due to those located in suburban or exurban communities in the U.S. [20]. Many schools in Georgia today are very large due to a long-standing belief that larger schools provide economies of scale. One of the major drawbacks to large schools is the amount of land they require. In many Georgia school districts, *minimum* site sizes for elementary schools can be as large as 25 acres [21]. School districts usually see this as an advantage because the site can later be used for other facilities or expansion of the existing building. However, sites this large are difficult to find in existing neighborhoods. This forces school districts to look for undeveloped parcels that are usually far from current development. In turn, this decreases walking access and increases traffic to and from the school site.

Therefore, the minimum school site size can indirectly affect neighborhood development, transportation options, and walking and bicycling environment to school from its contribution to ‘sprawl school siting’ due to the limitation of available land to meet the minimum criteria. The reasoning of negative effects of ‘sprawl school siting’ on walking and cycling to school can be summarized as follows [22].

First, the low density development pattern, which is typical in sprawled suburban communities, increases a school service boundary, resulting in longer distances between local housing and schools. A study from Centers for Disease Control and Prevention (CDC) shows that the distance to school is one of significant barriers for students to walk or bicycle to schools.

Second, ‘sprawl’ schools are often accessed via major arterials. This generates safety issues when children walk and bicycle to schools. In fact, parents’ perception for safety and danger is the most common reason why they pick up and drop off children at school by car [23, 24].

Third, new schools located away from existing urbanized areas and infrastructure tends to have insufficient pedestrian infrastructure connected to local residential areas [25].

These features discourage both parent and children to walk and bicycle to schools, increasing traffic congestion during peak hours.

2.3 Public School Siting Decisions in Georgia

In 1985, legislation known as the Steinberg Act was passed in Georgia requiring local government planning departments to take certain considerations into account when reviewing rezoning applications [26]. The law applies to counties with populations over 625,000 (originally 400,000 but amended in 2002) and municipalities with populations over 100,000. As of the 2000 Census this means the law only applies to Fulton, DeKalb, and Gwinnett Counties. According to Census estimates, as of the 2010 Census, this will also apply to Cobb County. In addition to these counties, the Steinberg Act applies to the municipalities of Atlanta, Augusta, Columbus, Savannah, and Athens. Six criteria are required to be taken into consideration:

1) Whether the zoning proposal will permit a use that is suitable in view of the use and development of adjacent and nearby property;
2) Whether the zoning proposal will adversely affect the existing use or usability of adjacent or nearby property;
3) Whether the property to be affected by the zoning proposal has a reasonable economic use as currently zoned;
4) Whether the zoning proposal will result in a use which will or could cause an excessive or burdensome use of <u>existing streets, transportation facilities, utilities, or schools</u> (emphasis added);
5) If the local government has an adopted land use plan, whether the zoning proposal is in conformity with the policy and intent of the land use plan; and
6) Whether there is other existing or changing conditions affecting the use and development of the property which give supporting grounds for either approval or disapproval of the zoning proposal [27].

The law is designed to better coordinate planning efforts in the developed and densely populated areas of the state. Although Georgia is a "Home Rule" state in which the local governments have the ability to enact land use and zoning regulation without a role from the state, the law provides the state with the ability to specify procedures that the local government must follow [28].

This is particularly important to school districts because the law states that any rezoning must not cause "excessive or burdensome use" of the school facilities. In the case of school siting, this law may protect school districts from rezoning that they can prove are burdensome to the district. School districts could possibly use this statute to encourage county commissions to think carefully about the amount of development approved and how it impacts the school district.

While the Steinberg Act represented a big step towards coordinated land use planning in the state, the law only requires that these factors be considered, so rezoning decisions are not necessarily based on these criteria. Therefore, a county could choose to go through the checklist and still approve the rezoning even if the impact to the school district would be burdensome.

As noted above, in Georgia, school siting decisions are largely left up to individual school districts. Although the Georgia Department of Education (GaDOE) does have site selection criteria, the school district is usually the primary decision-maker in the location of the school site [29]. School sites are chosen by facility planners employed by the school district and these sites are approved by the board of education. Sometimes public hearings are held, but in many cases there is no public involvement process. GaDOE prefers not to get involved in school site decisions beyond determining if there is adequate utility provision (i.e. water, sewer, electricity) and adequate separation from environmental hazards (i.e. major highways, large natural gas transmission lines) [30].

The Georgia Department of Education has published a guidance document that school districts can use to evaluate a school site [31]. The document provides minimum acreage requirements, hazard guidance, and geographical considerations that should be taken into consideration when selecting a school site. GaDOE uses this document to evaluate all sites where state funds are used for construction. Although state funding cannot be used for land acquisition, the school must gain approval from the state school facilities office before proceeding with acquisition. The following factors have been identified by GaDOE as being important for the school siting decision.

Site Size. The GaDOE currently requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high schools, plus one acre per 100 students for each school type. For example, an elementary school with 600 students would require a minimum of 11 acres. The acreage requirement can be reduced via a waiver process if the school district provides adequate proof that the school site can still provide a safe and effective learning environment.

Until 2004, the Council of Educational Facility Planners International (CEFPI) recommended that school sites have minimum acreage requirements as follows:

- Elementary – 10 acres plus one acre for every 100 students
- Middle – 20 acres plus one acre for every 100 students
- High – 30 acres plus one acre for every 100 students

Many states have used this recommendation as a basis for their own site requirements [32]. In 2004, CEFPI removed minimum site requirements from their influential publication entitled *Guide for Planning Educational Facilities* citing that a "one size fits all" approach is outdated and works counter to a variety of goals [33]. The rescinding of site size requirements was a result of historic preservation literature and research in the education field related to small schools and their relationship to improved student performance. Although CEFPI no longer suggests a minimum site size, Georgia retains its minimum site size standards (along with 27 other states) [34]. The schools in this research were built when CEFPI's site size recommendations were still in place.

Risk Hazard Assessment. Schools must consider potential safety hazards near the school site. These can include high voltage electrical transmission lines, petroleum transmission lines, propane storage facilities, railroads, major highways, airport flight patterns, and industrial facilities. For most hazards, GaDOE recommends that the site be “free of conditions and installations which endanger the life, safety, and health of children” [35]. GaDOE also recommends that school sites avoid sites adjacent to heavily traveled streets.

Geographical Factors. Finally, GaDOE recommends that the site be supportive of an efficient transportation system. This seems contrary to the previous requirement that the site be located away from heavily traveled streets. GaDOE also recommends that the site be “accessible to community services needed by the district and the school should be appropriately located with respect to other schools and the population to be served.”

2.4 Land Use Planning and School Planning: Examples from Other States

One of the criticisms of those interested in comprehensive planning has been a lack of cooperation between land use planning and school planning. As separate government entities, school districts and local governments can and often do operate in isolation from one another. This disjointed planning can result in decisions that negatively impact the community. One example of this is the effect of schools on development patterns. Research has noted that when schools are sited on the urban fringe or in rural areas, they act as magnets for growth. Young families with children often move out of older neighborhoods to have their children attend the modern schools [36].

Some observers have described the demand for schools as a circular process. Families see the declining quality of schools in urban areas and move to suburban locales so their children can attend higher quality public schools. Then, suburban school districts are overwhelmed with additional enrollment and are forced to build new facilities. From that point, “hopscotch development takes place and the process starts all over again” [37]. This pattern presents two problems. First, it leaves urban school districts with a declining enrollment and a disproportionate amount of low income students whose parents cannot afford to move to the suburban schools. Second, it promotes sprawl and puts development pressure on the land surrounding the new school.

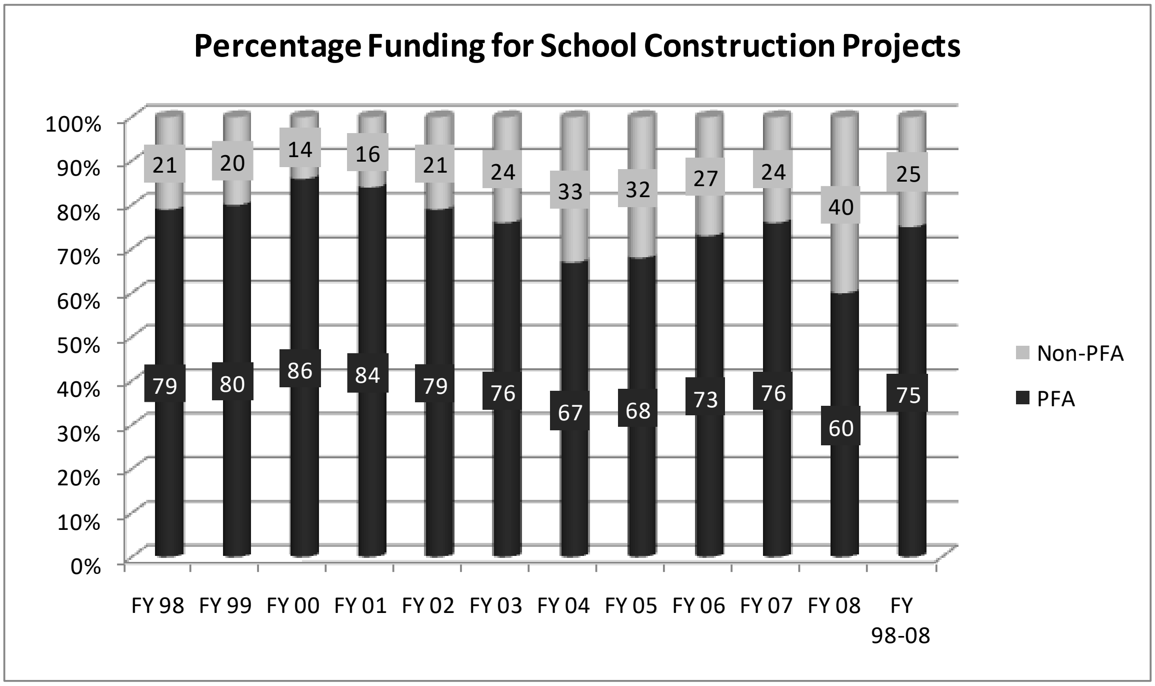
When school planners respond to increasing enrollments in suburban districts, most often the response is to build new school buildings. The major question is *where* should new schools be built? Some of the most compelling literature on school siting comes from the historic preservation literature. The National Trust for Historic Preservation has published studies that argue historic schools are worth renovating to ensure that traditional neighborhoods continue to have walkable school sites [38]. The literature points out several policy obstacles to making existing school preservation a priority including site size minimums, funding bias towards new schools, lack of maintenance on existing buildings, and lack of coordination between local government and school planners [39]. As described below, Maryland and Florida are both examples of states that have taken a leadership role to address the issue of school siting and its impacts on development.

Maryland's Priority Funding Areas - Maryland is one of the most notable states in terms of placing priority on smart growth. Maryland began recognizing the impact of school sites on sprawl development in 1991 when the Executive Director of Maryland's Public School Construction Program, sent a memo to school superintendents throughout the state, noting that sprawl development "unnecessarily harms the environment, is wasteful of public infrastructure investment, and is not cost effective. Therefore we will seek to avoid budgeting for [school] projects that contribute to sprawl development" [40].

The Maryland model for smart growth includes a program called Priority Funding Areas (PFAs). This program targets state funding for projects to build public sewer, water, schools, and housing for areas designated by the state that are targeted for growth. Infrastructure completely funded locally can still occur outside PFAs and this has been criticized by some observers as being a serious flaw in the legislation. Many new extensions of sewer and water lines have been paid for by private developers, making it difficult to truly implement the PFAs as intended [41]. When the program was first created in 1997, state funding was only allowed for schools in a PFA. Now the state has relaxed the requirements due to concerns that rural schools were adversely impacted by the requirement [42]. However, the state funding formula still favors schools that are located in established neighborhood or within municipal corporate limits. Figure 2.2 illustrates the percentage distribution of funding allocated to schools in PFAs.

In Maryland, the following criteria are used to evaluate the merits of school construction:

- “Projects should not encourage sprawl development
- Projects should not be located in agricultural preservation areas…unless other options are not viable and the project’s development will have no negative effect on future growth and development in the area
- Projects should encourage revitalization of existing facilities, neighborhoods, and communities
- Projects should be located in developed areas or in locally designated growth areas



Source: Maryland Department of Planning [43]

Figure 2.2. Maryland Construction for Schools in Priority Funding Areas (PFAs)

- Projects should be served by existing or panned water, sewer, and other public infrastructure" [44]

Another component to the Maryland program is a focus on funding improvements to existing infrastructure. Unlike most states, Maryland's policy on capital funding favors existing schools over new construction. Prior to the state's new policy, state renovation funds would only pay for existing building infrastructure such as electrical or mechanical equipment. Governor Parris Glendenning's administration (1995-2003) changed the policy to include improvements to facilities that included computer equipment, air conditioning, and other structural elements. Prior to 1991, 66% of the school's construction funds went towards new construction, while only 34% went into renovations of existing schools. From 1997 to 2001 capital improvements to existing schools made up 95% of school capital projects. This comprised 83% of the state capital budget for schools in Maryland. Maryland's matching policy for schools also favors existing schools. The state will fund 50% of costs for schools that are between 16 and 25 years old; 60% if the school is 26 to 40 years old; and 85% if the school is 41 years or older [45]. This helps encourage districts keep to historic schools and makes the return on investment much higher for doing so.

Although Governor Glendenning's administration ended in 2003, the PFA program for schools remains in place. In 2006, the Maryland legislature passed HB 1141 which required additional elements be adopted into municipal comprehensive plans. The law called for a Municipal Growth Element that, among other things, provides an analysis of school capacity by using the projections of students per household in a new development. This placed additional state requirements on land use planners to incorporate school planning into the comprehensive planning process [46].

Florida's School Concurrency - Florida is considered a national leader in smart growth principles. In Florida, Adequate Public Facilities Ordinances (APFOs) ensure that when development occurs, other public infrastructure is in place or planned to serve the development. Adopting an APFO is an option for each local government, and many have done so to help give utilities such as water and sewer districts a coordinated plan that would take into consideration capacity constraints as new development is approved.

In 2000, Orange County Chairman Mel Martinez asked county planners to start considering school capacity as part of their development approval process. This plan, known as the Martinez doctrine, states that if a development causes a school to increase its enrollment to greater than 125% of capacity, then the developer is required to help solve the capacity issue [2]. This doctrine was challenged by several lawsuits, but was ultimately upheld by the Florida Supreme Court in 2003 [47].

In 2002, Florida passed a law that requires school districts and local planners to use common growth management plans, population projections, development review bodies, and funding strategies. The legislation also requires that the school districts and local governments have a formally executed agreement [6]. A 2005 amendment to the law requires that all school districts integrate schools into their comprehensive land use plan by 2008 [48].

Many believe the new requirements have been effective. School planners are cooperating with local planners to share data and strategies to implement smart growth principles. According to a report by the International City/County Management Association, the law has improved all aspects of planning coordination [2]. Fewer schools are overcrowded and responsibility is placed on developers to help provide the public facilities necessary as a result of their development. School planners and local planners are sharing data and meeting regularly to review plans and discuss school capacity issues.

2.5 Summary

The literature on how school sites relate to development patterns is limited. Although there has been extensive research done in the area of determining land values as they relate to neighborhood characteristics, little work has been done to specifically analyze the impact of school sites on development patterns. This is largely because of the difficulty of determining the reason households move from place to place. Economic conditions, social constructs, and job location all play important roles in households' decisions on where to locate, but usually these decisions need to be analyzed in the context of a household survey to determine causality.

In Georgia, the Steinberg Act (1985) required large population centers like Atlanta to take a look at schools as a consideration when approving new development. While counties and municipalities are not *required* to make development approval decisions on the basis of school (and other infrastructure), they must take these matters into consideration before making a decision to approve a development. School districts and local governments are not required to coordinate in their planning efforts in Georgia, as they are in some other states.

Chapter 3: DATA COLLECTION AND PREPARATION

This chapter describes the data collection and preparation processes used to examine the impact of school siting decisions on development patterns and on transportation infrastructure. This chapter does not present the approach used to examine the funding implications of education and transportation SPLOSTs, which is presented in chapter 6.

The data used in this study came from a variety of sources. Quantitative data came in the form of parcel data from counties, school construction date data from the Georgia Department of Education (GaDOE), transportation network data from TransCAD software (using 2000 Census TIGER/Line network), and traffic data from the Georgia Department of Transportation (GDOT). In addition, census data was used to determine those counties in which school systems were growing rapidly. Qualitative data was obtained through a series of telephone interviews with school facility planners, school board members, GaDOE staff, and Georgia School Boards Association (GSBA) staff.

3.1 Data Sources: Parcel Data

Parcel data was collected from seven counties in Georgia. The Geographic Information System (GIS) manager for each county was contacted and data requested. Parcel data for the entire county was requested, which included attribute information for "year built" and "land use." In addition, school attendance boundary data was requested. Table 3.1 shows a summary of the data that was collected. The data was not available for the same time periods for all counties. In order to ensure that all the data exhibited similar characteristics, the records having partial "most recent year built" data were excluded from the analysis. For example, if the dataset had some values for 2007, it was considered to be complete only up to 2006. Therefore, no records with 2007 "year built" values were used.

Table 3.1. Parcel Data Available for Analysis

County Code	Character Type	Land Use	Year Built	School Attendance Boundaries	Year of Data
A	Mature Urban	x	x	x	2005
B	Mature Suburban	x	x	x	2007
C	Developing Exurban	x	x	x	2006
D	Rural	x	x	x	2007
E	Developing Exurban	x	x	x	2007
F	Developing Exurban		x	x	2007
G	Rural	x	x	x	2007

The counties used in the analysis represented a cross-section of Georgia's development environments, representing four unique county types: 1) *mature urban*, 2) *mature suburban*, 3) *developing exurban*, and 4) *rural*. The rural county selected was within reasonable distance to a population center so some potential impact of growth could be observed. County names were kept confidential to respect the entities that provided the data and to comply with agreements for use of the data. Thus, in Table 3.1, counties were identified as counties A to G.

Preparation of Parcel Data for Analysis - For many of the county datasets, the geographic parcel data had to be joined with the cadastral data provided by the county tax assessor. In some cases, this data had to be manipulated so that the Parcel ID matched the cadastral dataset from the county assessor. For this analysis the Effective Year Built (EYB) was used instead of the Actual Year Built (AYB). Assessors use AYB to record the first time a structure was built on a location. EYB differs from AYB when a significant renovation was done on the existing foundation. Since this research is seeking to find the impact of school siting on development, using the EYB will give a better signal of development and incorporate renovations as well as new construction. Some counties provided data in a format where no processing was required.

However, for some counties special processing steps were taken to get the data into a reasonable format. These procedures are discussed below.

County E Data Preparation - The geographic parcel data collected from County E was in shapefile format. The data was obtained from the Georgia GIS Clearinghouse and appended with a comma delimited text file supplied by the County Tax Assessor's Office. The data for matching Parcel ID was not uniform and had to be processed in order to have a good common identifier for the data join. Out of 92,241 records in the original geographic dataset, 66,851 (72%) were successfully matched to the cadastral data provided by the tax assessor. The remaining parcels had no building information, and were assumed to be undeveloped. Due to school selection criteria (discussed later), this data was not used in the final analysis.

County G Data Preparation - The parcel data obtained from County G did not have a Parcel ID that was usable to join with the cadastral data. In order to make the table join possible, the Parcel ID was parsed into its elemental components. These components then formed a uniform Parcel ID that would be able to join to the cadastral data. In total, there were 35,098 records in the geographic parcel dataset. After the join was complete, there were 35,077 successful matches, for a success rate of 99.9%. The dataset yielded 12,663 (36%) parcels in which there was no building information. These parcels were assumed to have no improvements on the land. Due to school selection criteria, this data also was not used in the final analysis.

3.2 Data Sources: School Construction Database

A school construction database was obtained from GaDOE. This database was sent as Excel™ files that were imported into Access™ for more efficient data processing. Data was requested for each year from 1990 through 2007. In order to make this data useful for the analysis some processing had to be undertaken. First, all schools with a school code of "16xx" were removed. This was based on the advice of the GaDOE staff because these reference numbers did not represent new schools, but merely schools that had been renumbered. Next, schools with an opening date of 1/19/2008 were removed from the dataset. Again, this was on the advice of GaDOE staff because of a flaw in the dataset.

3.3 Data Sources: Transportation Network Data

Transportation network data came from two primary sources: TransCAD™ data and GDOT traffic count data. Throughout the report, traffic count and the analysis of travel time are based on automobile trips. The TransCAD™ software package contained street network data for the entire United States based on 2000 Census TIGER/Line files. The data included attributes of roadway type in the form of the Census Feature Class Code (CFCC) and nodes at each intersection. The availability of CFCC and nodes allowed for a friction-based shortest time path network to be created to model travel times for different road classifications.

Before any analysis was done, the street dataset was clipped to the Georgia state boundaries to decrease the file size and processing time necessary to carry out procedures. The line dataset contained an attribute field called *length* that represented the length in miles of each line segment. There was also an attribute for CFCC. In order to develop travel time contours, average travel speeds for different road classifications were assumed. The assumed speeds and composition of road classifications are shown in Table 3.2. These speeds were adjusted down by five miles per hour from the posted speed limit to account for intersection and congestion delay associated with each node pair.

Travel times were calculated for each link in the network. Next, a network model was calculated and implemented in TransCAD™ based on minutes of travel time for each link. The network model contains the underlying data necessary to calculate drive-time catchment areas (called service areas) based on an origin node.

GDOT provided traffic count data as shapefiles for several of the counties in the study. Data was provided as point data at selected sites throughout the counties. This data was available for years 1998-2007. GDOT was asked to provide traffic count data for all roads in the counties

Table 3.2 Adjusted Speed and Distance by Road Type

CFCC	SumOfLength(mi)	Pct Of Total	Speed (mph)	Name
A11	261.90	0.15%	50	Primary road with limited access or interstate highway, unseparated
A13	7.41	0.00%	50	Primary road with limited access or interstate highway, underpassing
A15	1,756.58	1.03%	50	Primary road with limited access or interstate highway, separated
A16	0.12	0.00%	50	Primary road with limited access or interstate highway, separated, in tunnel
A17	10.45	0.01%	50	Primary road with limited access or interstate highway, separated, underpassing
A18	0.07	0.00%	50	Primary road with limited access or interstate highway, separated, w/ rail line in center
A21	10,345.22	6.06%	35	Primary road without limited access, US highways, unseparated
A22	1.33	0.00%	35	Primary road without limited access, US highways, unseparated, in tunnel
A23	1.96	0.00%	35	Primary road without limited access, US highways, unseparated, underpassing
A25	1,186.57	0.70%	35	Primary road without limited access, US highways, separated
A27	0.06	0.00%	35	Primary road without limited access, US highways, separated, underpassing
A29	0.37	0.00%	35	Primary road without limited access, US highways, bridge
A31	6,659.37	3.90%	25	Secondary and connecting road, state and county highways, unseparated
A32	1.15	0.00%	25	Secondary and connecting road, state and county highways, unseparated, in tunnel
A33	7.26	0.00%	25	Secondary and connecting road, state and county highways, unseparated, underpassing
A34	0.24	0.00%	25	Secondary and connecting road, state and county highways, unseparated, with rail line in center
A35	101.32	0.06%	25	Secondary and connecting road, state and county highways, separated
A38	3.74	0.00%	25	Secondary and connecting road, state and county highways, separated, with rail line in center
A39	0.04	0.00%	25	Secondary and connecting road, state and county highways, bridge
A41	139,574.68	81.78%	20	Local, neighborhood, and rural road, city street, unseparated
A42	6.46	0.00%	20	Local, neighborhood, and rural road, city street, unseparated, in tunnel
A43	10.41	0.01%	20	Local, neighborhood, and rural road, city street, unseparated, underpassing
A44	1.85	0.00%	20	Local, neighborhood, and rural road, city street, unseparated, with rail line in center
A45	51.82	0.03%	20	Local, neighborhood, and rural road, city street, separated
A46	1.21	0.00%	20	Local, neighborhood, and rural road, city street, separated, in tunnel
A49	4.32	0.00%	20	Local, neighborhood, and rural road, city street, bridge
A51	1,609.86	0.94%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A52	0.22	0.00%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, in tunnel
A53	1.73	0.00%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, underpassing
A54	28.85	0.02%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, underpassing
A56	8,462.19	4.96%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A57	78.17	0.05%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A63	487.68	0.29%	10	Access ramp, the portion of a road that forms a cloverleaf or limited access interchange

studied. This was provided as a geodatabase that could be rendered in ArcGIS™ for analysis purposes. Each county had bidirectional Average Annual Daily Traffic (AADT) counts for years

1998 through 2007. Some counts were estimates, while others were taken annually and reflected actual traffic volume as measured by GDOT.

Analysis was done using GIS to extract the data points that fell within the school attendance boundary, with data exported from GIS and analyzed in Excel.™ Traffic count stations with a zero reading for any given year were removed. Valid data points ranged from 2 to 17. These data points were averaged for each year of analysis. This allowed for estimates on a year by year basis of average traffic within the school attendance boundary.

3.4 Data Sources: Interviews

A clear understanding of how site planning occurs in Georgia was critical to understanding the decision-making framework for site selection. Over the course of three months, 17 interviews were conducted with a variety of school districts and state agencies. Each interview lasted between 20 and 50 minutes and covered a variety of questions. Interviews were conducted with school facility planners, school board members, GaDOE, and the Georgia School Board Association. Separate questionnaires were created for each agency type interviewed. A complete list of questions can be found in **Error! Reference source not found.**.

One week before each interview, the questions were e-mailed to the interviewee so that he/she could be prepared to answer the questions during the interview. During the interview, the interviewees were given an overview of the research project and asked to be as candid as possible about the planning process. Interviewees were assured that their personal information would be kept confidential and they would not be identified in the research. Notes were collected for each phone interview and summarized immediately after the interview ended.

A cross section of Georgia school districts was selected for interviews. All four districts selected for spatial analysis were interviewed as well as some professionals from other counties. In addition, the Facilities Services Director of the GaDOE and a representative from the Georgia School Board Association were interviewed. Developing exurban counties were oversampled due to the high growth rate of these counties. There was a greater likelihood to have a robust school capital program in these counties, whereas counties that are more mature may have less in terms of new school site decisions. Table 3.3 shows the details of the interviews conducted.

Table 3.3. Interviewee Summary

County Type	Title of Interviewee	Type
Developing Exurban	Facilities coordinator	Facility Planner (FP)
Developing Exurban	Board Chair	Board Member (B)
Developing Exurban	Facilities director	FP
Developing Exurban	Board Chair	B
Developing Exurban	Director of Facility Services	FP
Developing Exurban	Facilities planner	FP
Developing Exurban	Board Chair	B
Developing Exurban	Exec. Director of Facilities and Maintenance	FP
Developing Exurban	Board Chair	B
Developing Exurban	Exec. Director, Maintenance & Facilities	FP
Mature Suburban	Board member	B
Mature Suburban	Facility planner	FP
Mature Suburban	Director of Planning	FP
Rural	Director of Administrative Services	FP
Rural	Board Chair	B
State Agency	Director of Facilities	State official (S)
State Agency	Professional development specialist	S

Chapter 4: METHODOLOGY AND ANALYSIS

To develop a good understanding of how school sites impact development patterns, a two-part research analysis approach was adopted. The first part was a quantitative analysis using GIS software. This approach involved determining the number of newly developed parcels near school sites before and after the school was built and comparing that growth rate to the county average growth rate over the same time period (the term "out years" will be used to describe the year the school opened and all subsequent years). To maintain consistency, the growth rates were calculated based on the number of structures, not the actual population. This method was used primarily because there was not a reliable method by which to get population data on a yearly basis. Population data was only available in five year increments. The second part of the research involved phone interviews with school facility planners from across Georgia to ask questions related specifically to how school facility planning is done in the state.

4.1 School Selection

The schools selected for the geographic analysis were made based on a database obtained from the GaDOE. A query was run to determine the schools that were built between 1995-2000. This time period was desirable because it would provide a minimum of seven out years for the analysis. The process for selecting schools had four main criteria for the data:

1) Sufficient GIS data from the county to support analysis (parcel geography and effective year built attribute data)
2) School located on site that was previously undeveloped
3) Available traffic data from GDOT available
4) County profile description (mature urban, mature suburban, developing exurban, and rural) met

Figure 4.1 shows the process for selecting schools for analysis. Due to the time to analyze and prepare the data, only two schools were selected from each county. It was assumed that middle schools would have similar development characteristics as elementary schools and that the resulting development pattern would be similar. Therefore, only one elementary school and one high school were analyzed for each of the four districts, for a total of eight schools.

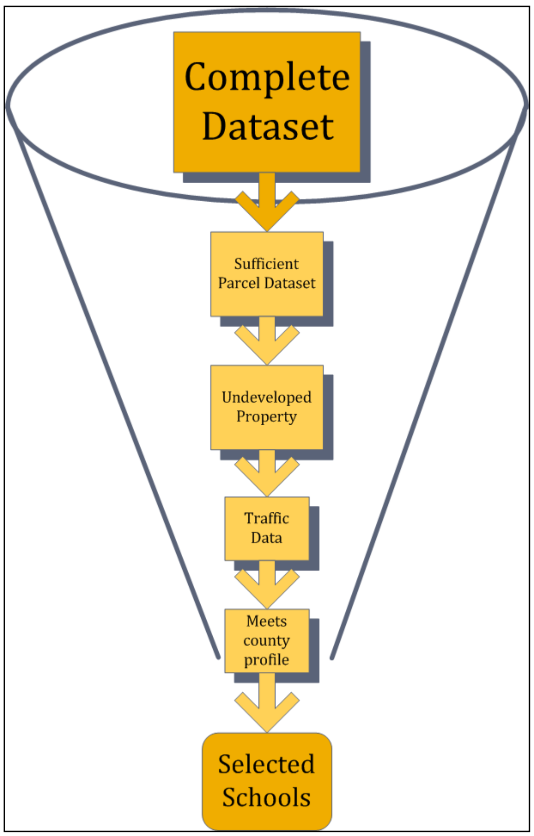


Figure 4.1. School Selection Process

4.2 Developing Travel Time Contours

The spatial relationship between a school and its surrounding development is important. Two methods can be employed to determine spatial relationship---Euclidian distance and network distance. Euclidian distance refers to “as the crow flies” distance from a point, easy to determine using a spatial buffer in any GIS software. Network distance is based on the street network and reflects the practical travel pattern of a vehicle or pedestrian. In the land use context, network distance is the most appropriate and most robust form of analysis, so this method was used.

The first step in developing the network distance was to construct a network model based on the 2000 Census TIGER/Line data files. This process provided the necessary friction factors to construct travel time contours. The next step was to select the nearest intersection node to the school site (see Figure 4.2). This process involved visually identifying the nearest network node to the selected school site, that is, the nearest intersection from which a trip would begin from the selected school site. Next, travel time contours were computed using the nearest node as the base point and calculating network bands extending outward. Multiple network bands were computed to determine travel time in minutes from the school site. Increments of two minutes were used with travel time contours extending as far as necessary to encompass the entire attendance boundary of the school in question. Figure 4.3 illustrates the travel time contours calculated for a school. Note that the attendance boundary has been used as the reference for determining how far to extend the travel time contours. Travel time contours only extend to the point necessary to encompass the entire school attendance boundary.

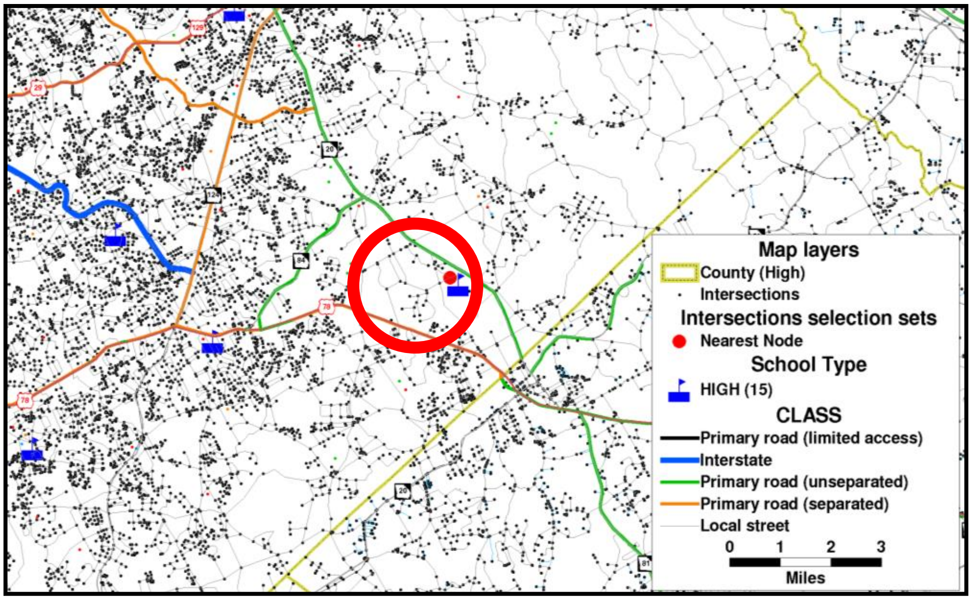


Figure 4.2. Nearest Node to High School B

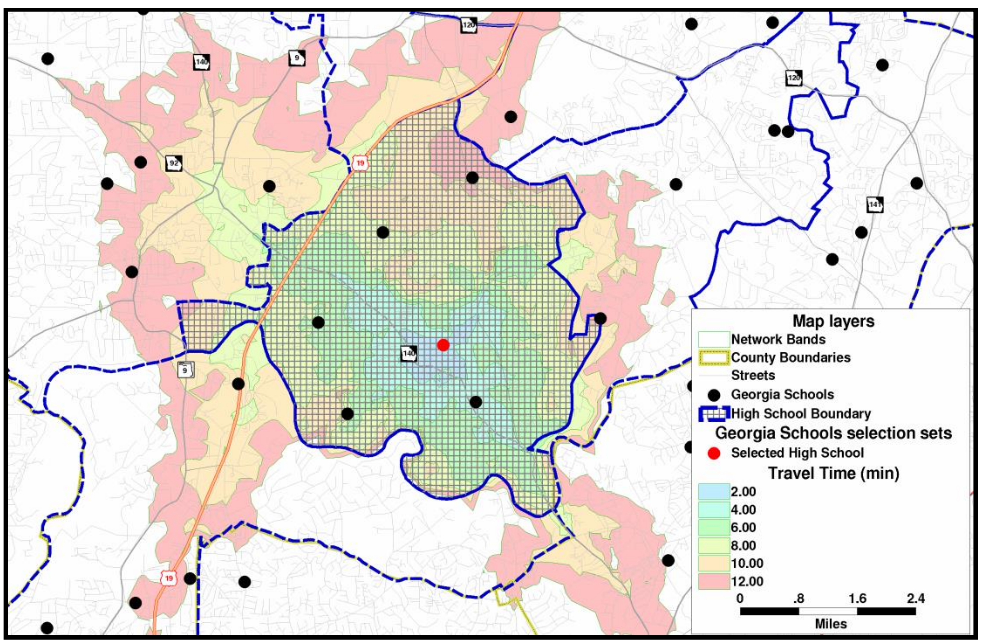


Figure 4.3. Travel Time Contours from School's Nearest Intersection

4.3 Analysis in GIS

After travel time contours were determined, the file containing the contour geography was exported to a shapefile so that it could be used in ArcGIS.™ The file was opened in ArcGIS™ and was re-projected so it would be in a datum consistent with the rest of the parcel data (this was usually Georgia West State Plane-Feet). Next, the *Select by Location* function was employed to select only the parcels that fell within the specific school attendance boundary. For analysis purposes, only parcels with year built dates 1990 and out were selected. These parcels were exported to a separate shapefile. This file was then converted to points using the *Feature to Point* tool in ArcGIS. The output points represented the centroid of each parcel within the school attendance boundary. Figure 4.4 illustrates the travel time contours along with the parcel centroids within the school attendance boundary.

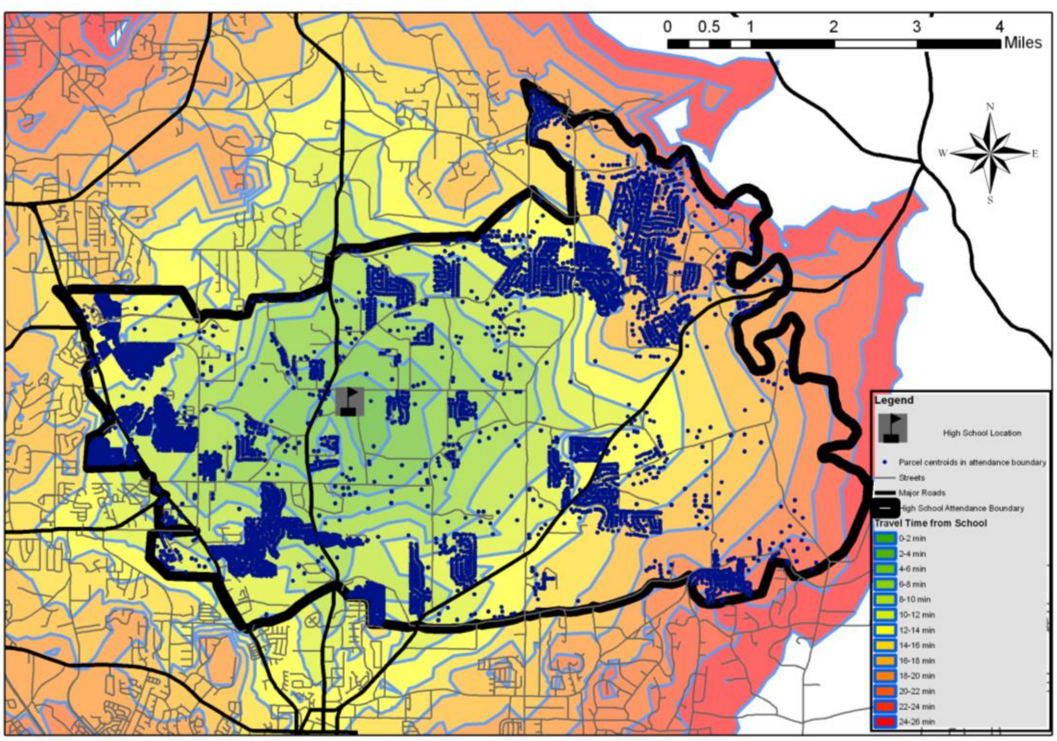


Figure 4.4. Travel Time Contours with Parcel Centroids Since 1990

It was assumed that parcel centroids took on the attributes of the travel time contour in which each point is contained. Because points, not parcels, are used, each point can fall only in one travel time contour. Each parcel was then spatially joined to the travel time contour it was in. This produced a table output that summarized travel times, and a cross tabulation was calculated based on year and network distance from the school. Figure 4.5 illustrates the cross tabulation result for an elementary school. The school was built in 1999, so the cells from 1999 forward are shaded to indicate the time period after the school was built.

		Travel Time (min)										
	Year Built	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	Total New Structures
Before school opened	1990		4	5	5	5	9	2	1	12	2	45
	1991			3	11	1	28	6	1	5		55
	1992			4	5	3	22	3		7	4	48
	1993		2	5	28	6	19	5		1	2	68
	1994	1	1		28	18	18	1	2	1		70
	1995	1		30	14	12	38	4	5	2	1	107
	1996	2	3	16	18	9	45	14	7	32	15	161
	1997	5	5	43	33	22	40	10	7	27		192
	1998	14	19	15	53	23	35	2	2	25	26	214
After school opened	1999	5	20	2	28	27	33	3	5	8	7	138
	2000	4	15	30	25	22	28	19	6	37		186
	2001	3	9	25	59	55	61	21	23	12	1	269
	2002	4	13	29	30	48	20	8	14			166
	2003	1	27	42	22	39	20	12	12			175
	2004		5	28	31	31	4	12	20			131
	2005		6	12	10	11	17	8	16	3		83
	Total	**40**	**129**	**289**	**400**	**332**	**437**	**130**	**121**	**172**	**58**	**2108**

Figure 4.5. Cross Tabulation of Year Built and Travel Time

4.4 Analysis of Relationship

Developing a *robust* case for causality involves four elements: association, non-spuriousness, time precedence, and theory [49]. The question of association can be addressed using statistical measures such as the chi-square test or correlation. In this case, the chi-square and the Cramer's V tests were the most appropriate [50]. The variables were set up such that travel time contours could be grouped together and counted as column summations and the row variable would represent the time period before and after the school was built.

The question of non-spuriousness is more difficult. There are many factors in land development that are not easily controlled for statistical significance. For example, this dataset does not control for neighborhood characteristics such as income, racial composition, and household size. The information was not available since the analysis was done on a school attendance boundary level and not census block group level. Furthermore, the data analysis is based on an annual growth rate and the Census block group level data is available only at the decennial Census. This makes it difficult to determine neighborhood characteristics over time. Lacking this information could leave out some spurious correlations between variables outside of the scope of this project.

Time precedence asserts that if event A causes event B, then A must precede B. Time precedence can be achieved by showing growth rates before and after a school was built. Because all school sites were selected based on the condition that there was no school on the site previously, it can be shown that there is time precedence by calculating the rate of growth at the time the school was built and compare the growth rate that occurred after the school was opened. To separate extraneous impacts of the broader economy, the overall growth rate for the county was also calculated and subtracted from the growth rate for the school attendance boundary to segregate the school's impact from the environmental factors of the economy and housing market at-large.

Finally, there must be theory to support the argument of causation. Although very little significant empirical evidence exists on school sites and growth, the majority of professionals interviewed as part of this effort agreed that there was definitely a relationship between residential choice and school location. This evidence supports the assertion that there is at least some degree of causal relationship.

In order to develop sound measurement techniques, two statistical measures were employed. The Pearson's chi-square test is a comparison between the frequencies that would be expected if the variables were completely independent with the frequencies actually observed from the sample. While the chi-square test provides a way to positively test for independence, it says nothing about the strength of the relationship. To make the analysis more robust, a Cramer's V test was employed. The Cramer's V indicates the strength of the relationship proved using the relationship shown from the chi-square test.

Pearson Chi-Square Test – To measure the association of development patterns, the Pearson's chi-square test is specified by the function:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where χ^2 = the chi-square statistic, O_i = the observed frequency for event i, E_i = the expected frequency for event i, and n = the number of possible outcomes for each event.

The test was set up so that the null hypothesis was that the variables of school built and travel time from the school were independent. Table 4.1 illustrates the setup for the chi-square test. The percentage of the total for the category *School Built* is applied to the <=10 minute total and

Table 4.1. Chi-Square Test Setup

Observed	Travel Time		
	<= 10 min	>10 min	Total
School Built	4362	4533	8895 *(67%)*
School Not Built	1878	2473	4351 *(33%)*
Total	6240	7006	13246 *(100%)*

Expected	Travel Time		
	<= 10 min	>10 min	Total
School Built	4190	4705	8895
School Not Built	2050	2301	4351
Total	6240	7006	13246

the >10 minute total to obtain values that would be expected if the travel time variable had no relationship to whether the school was built. On the column summation, the travel time was aggregated based on how many travel time contours existed in the school attendance boundary. For example, the travel time contours for the high school in County B ranged from zero to twenty minutes. The travel time was separated into two bins: less than or equal to 10 minutes and greater than 10 minutes. The rows were the year of construction for each new structure in the school attendance boundary. These rows were aggregated into two categories: one for structures built before the school opened and one after the school opened. This essentially created a dataset of nominal categorical variables. In all cases, there was a sufficient sample size for statistical analysis.

Observed frequencies were first cross-tabulated and then expected frequencies were calculated based on a null hypothesis of no relationship between the two variables. A sample result for County B is illustrated in Table 4.2.

A further step was taken to disaggregate the travel time into more than two bins. It was thought that this approach might give additional strength to the assertion that the two variables

Table 4.2. 2x2 Chi-Square Test Result for County B

	Observed	Expected	**(Obs-Exp)^2/Exp**
School Built, <=10 min	4362	4190	7.035
School Built, >10 min	4533	4705	6.266
School Not Built, <=10 min	1878	2050	14.382
School Not Built, >10 min	2473	2301	12.810
		Chi-Square	**40.492**
		Cramer's V	**0.055**
		Significant at:	0.05
			YES

were not independent. As mentioned previously, the original travel time contours were at two minute intervals. Since each school had differing numbers of travel time contours based on the attendance boundary size, the data was aggregated such that the minimum bin size was two minutes and there was a maximum of six bins. A separate chi-square test was then run on the new disaggregated data.

Cramer's V Test - While the chi-square test is useful to affirm that a relationship does exist, it says nothing about the strength of the relationship. In order to determine the strength of the relationship, the Cramer's V test is used. This test is based on the chi-square test and can determine the strength of association between the variables. Cramer's V is specified by the function:

$$V = \sqrt{\frac{\chi^2}{n(k-1)}}$$

Where V = Cramer's V, χ^2 = the chi-square statistic, n = the number of observations, and k = the smaller of the number of rows and columns.

Cramer's V has a range of 0.0 to 1.0, with 0.0 indicating no relationship between the variables, and 1.0 indicating a perfect relationship. This measure controls for the number of cases and provides a standardized method to analyze the strength of the relationship. Because

Cramer's V is always positive, there is no assumption of the direction of the relationship, only that there is a relationship and the strength can be calculated. For example, a value of 0.25 indicates that 25% of the variation of between school years can be explained by this relationship. The other 75% of variation is explained by variables not included in the analysis. It is likely that these omitted variables include the condition of the housing market, land use policies, price of land, and availability of developable land. These variables would come into play in a traditional hedonic pricing analysis, but are not included in this study.

The next chapter presents the results of the analysis methods described in this chapter.

Chapter 5: RESULTS AND DISCUSSION OF THE SCHOOL SITE ANALYSIS

This chapter presents the results of the statistical analysis relating school siting and development growth.

5.1 Statistical Results of Spatial Analysis

The analysis of the relationship between a school being built and development occurring in the school attendance boundary showed that there was a statistically significant relationship. For all eight schools analyzed, the relationship was significant at the 95% confidence level. These results can be interpreted to mean that the relationship between a school's existence and development around the school site are not independent. Table 5.1 summarizes results from the chi-square and Cramer's V tests. This table shows the results of two separate Chi-Square tests. The first combines travel contours into two bins (i.e. greater than 10 minutes and less than 10 minutes travel time). The second uses *x* travel time bins (depending on the farthest travel distance from the school), in two-minute increments. For example, a school with the farthest driving distance of 12 minutes would have six travel-time bins (0-2 min, 2-4 min, etc).

Although the Chi-Square statistic was significant when travel-time contours were aggregated into two bins, the Cramer's V test did not show a strong relationship. The only notable results

Table 5.1. Summary of Chi-Square and Cramer's V Statistics

	Chi-Square (2 travel-time bins)	Cramer's V (2 travel-time bins)	Chi-square (*x* bins, 2-min increments)	Cramer's V (*x* bins, 2-minute increments)
County A: Elementary	38.0	0.134	95.8	0.213
County A: High	40.6	0.134	302.3	0.290
County B: Elementary	31.8	0.107	323.1	0.341
County B: High	40.5	0.055	839.3	0.252
County C: Elementary	73.9	0.195	261.5	0.368
County C: High	9.0	0.042	164.4	0.178
County D: Elementary	4.7	0.074	32.8	0.195
County D: High	8.4	0.047	288.7	0.274

Were County A's elementary school (0.134) and high school (0.134) and County C's elementary school (0.195). When two-minute bins were used, the Cramer's V test revealed a much stronger relationship. Values ranged from 0.195 for the high school in County D to 0.368 for the elementary school in County C. The Cramer's V was consistently stronger in the mature suburban county. This would suggest that new school construction had a more significant impact on development patterns in the developing exurban setting than other county types.

Another way to look at the results is to compare the new structure growth rate in the school attendance boundary to the new structure growth rate in the county at-large. This method not only shows a localized growth rate, but controls for systematic economic effects that are occurring within the county as a whole. For each school, the growth rates were compared year to year to determine if the school attendance boundary grew faster than the county. The results of County C's high school are shown in Table 5.2. The grey shaded area indicates the time after the school was opened in 2000. A complete listing of the statistical results can be found in **Error! Reference source not found.**.

Table 5.2. Growth Rate Comparison for County C, High School

Year Built	% Growth School Attendance Boundary (A)	% Growth County C (B)	Difference (A) - (B)
1990	11.07%	6.83%	4.24%
1991	7.29%	5.93%	1.36%
1992	8.43%	7.53%	0.90%
1993	10.94%	8.08%	2.86%
1994	9.80%	7.61%	2.19%
1995	10.77%	7.94%	2.83%
1996	14.02%	9.41%	4.61%
1997	14.74%	8.44%	6.30%
1998	15.05%	8.35%	6.70%
1999	15.74%	9.40%	6.34%
2000	12.70%	8.56%	4.14%
2001	8.93%	8.25%	0.68%
2002	9.64%	8.47%	1.17%
2003	9.21%	7.93%	1.27%
2004	7.59%	6.81%	0.78%
2005	7.30%	6.61%	0.70%
2006	5.34%	6.14%	-0.81%

In this case, in every year except 2006, the school district grew faster than the county as a whole. In the years leading up to the school's opening, the growth rate exceeded the county growth rate by as much as 6.7%. After the school opened, growth rate came more in line with the county growth rate as a whole. Determining why this occurred is difficult. It could be due to the fact that development occurred in anticipation of the new school opening, usually school sites are announced several years before the school opens. .

School districts are required to develop five-year facility plans that account for expected growth. In County C's five-year plan, this school was expected years before the school actually was built. The school district would have accounted for this growth within the district long before the structures were built in the few years leading up to its opening. This suggests that the growth around the school might have been growth that was already taking place and the school district accurately predicted where the growth would occur and built the school accordingly.

A comprehensive look at the eight schools growth relative to their county's growth is shown in Table 5.3. These figures are only for the "out years," meaning those years including and after the school was opened. Here we see the number of years that the growth outpaced the county growth rate. For the mature urban county (County A), the elementary school's growth consistently outpaced the county growth in 86% of the out years. County A's high school was the opposite. Growth was slower in school attendance boundary than for the county in 78% of the out years. In the mature suburban county (County B), the figures are more consistent. For elementary and high schools, growth in the school attendance boundary outpaces the county growth rate in 67% and 100% of the out years, respectively. For the developing exurban and rural county (Counties C and D), the results are mixed. The data show that only the high school in the developing exurban county (County C) showed higher growth in a majority of the out years.

The elementary school for the developing exurban county and both schools in the rural showed that the school district grew slower than the county as a whole during the out years.

Table 5.3. "Out Years" Growth Summary

	No. of years School Dist **Grew Faster** than County Average	No. of years School Dist Did **Not Grow Faster** than County Average
County A (Mature Urban)		
Elementary	6	1
	86%	*14%*
High	2	7
	22%	*78%*
County B (Mature Suburban)		
Elementary	6	3
	67%	*33%*
High	8	0
	100%	*0%*
County C (Developing Exurban)		
Elementary	3	5
	38%	*63%*
High	6	1
	86%	*14%*
County D (Rural)		
Elementary	4	8
	33%	*67%*
High	5	7
	42%	*58%*

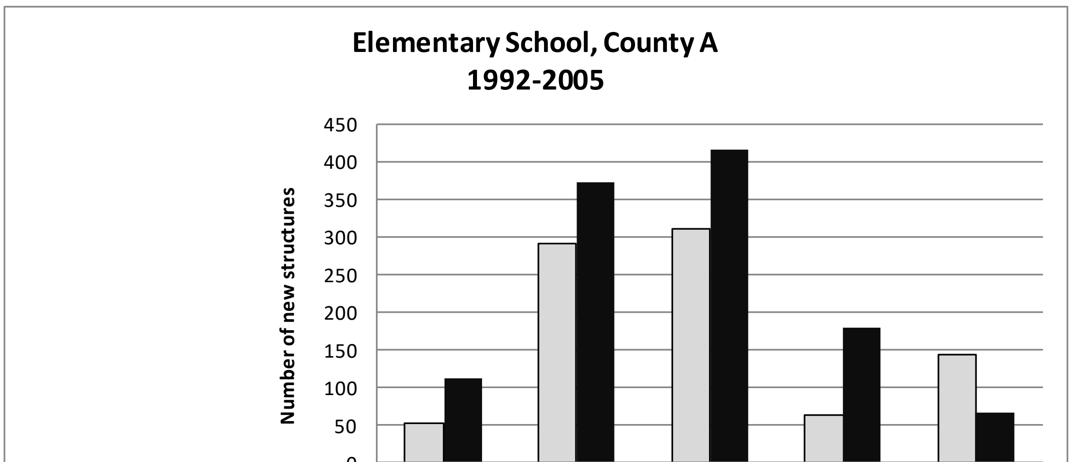
While these results may seem contradictory, it is recognized that the measures used here are subject to a number of different caveats. First, the research only shows the number of structures built. Since population data was not available between census years at a detailed level, the structures had to act as a proxy for population. It is possible, however, that the population numbers would result in different interpretations. Second, there are many more complex variables at play that are not taken into consideration, e.g., for example, school quality. Since the data used for this project narrowed down considerably the list of candidates for analysis, it was not possible to find schools that had similar characteristics in terms of quality and demographics. We know that school quality drives property values, so we could conclude that given a completely similar school, there might be more consistency between county types. Finally, due to limitations in the data, it was impossible to control for the amount of developable land. Variations in the amount of developable land at the time of the school construction could mean that growth was hindered in some districts.

5.2 Growth-Travel Time Profiles for Schools

As part of this analysis, the relationship between travel time distance and growth was analyzed. Data was separated into two bins. One for the structures built before the new school opened and another for the structures built after the new school opened. Because school opening years differed, each graph was adjusted to include an equivalent number of years before the school was built as after the school was built. For example, for County A, the high school opened in 1999, so the years 1990-1996 (total of seven years) were used for the "before" years, and years 1997-2003 (total of seven years) were used for the "after" years. The data revealed that in most cases there was an increase in the number of structures built after the school opened.

Figure 5.1 shows that for the elementary school in the developed urban county, the growth after the school was built exceeded the growth prior in every travel time band except the 16-20 minute band. We can also see from this figure that growth seems not to occur in great numbers in the area closest to the school. The 0-4 minute band has relatively small numbers compared to the 4-8 and 8-12 minute bands.

Figure 5.2 shows the same data for the high school in County A. Here we see that it appears that most of the growth occurred before the new school was in place. In the time period from 1990 to 1996 there were many more structures built than between the years of 1997-2003 after the school was opened. The pattern of structures located in the mid-range of travel-time remains consistent with what we have seen with the elementary school.



	0-4	4-8	8-12	12-16	16-20
1992-1998 (before school opened)	53	292	310	62	143
1999-2005 (after school opened)	112	373	416	179	68

Figure 5.1. New Structures, County A, Elementary School

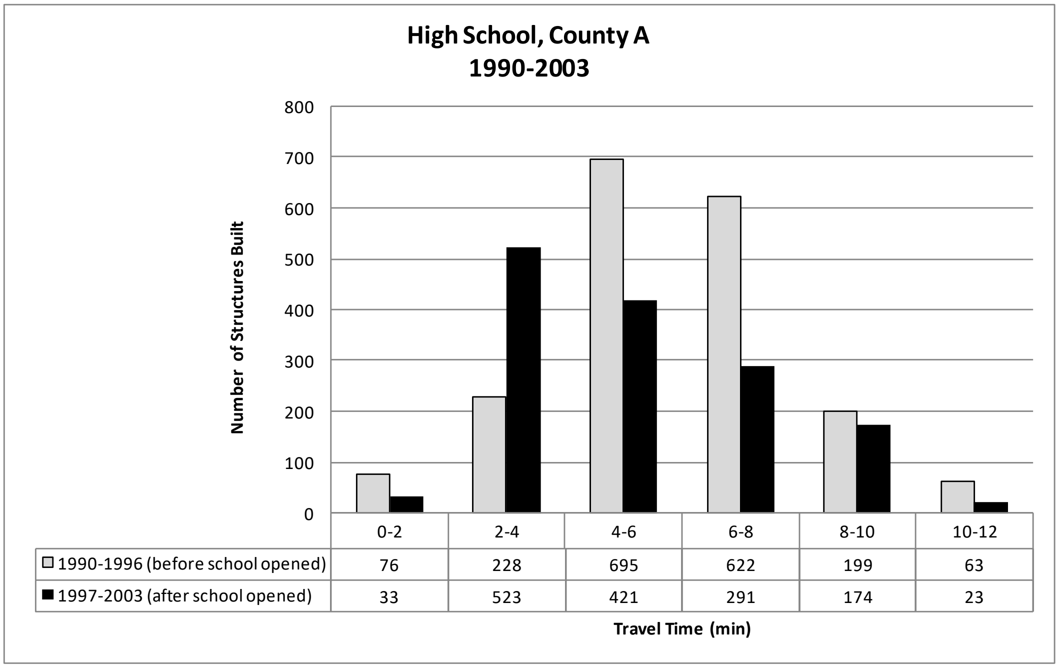


Figure 5.2. New Structures, County A, High School

Figure 5.3 shows the results for the elementary school in the mature suburban county, County B. In this case, the pattern of not much development located in the 0-2 minute band remains consistent, but the results show that in some bands, growth before the school opened was actually slightly higher than in the out years. However, the 4-6 minute band shows significantly more structures built in the out years. This was because a large development was built with 101 units the year after the school was built. Prior to that, the highest number of new structures for one year was 46.

The same pattern is even more pronounced in the mature suburban county where the growth is significantly higher in the years after the school was built (see Figure 5.4). Here, development also tends to follow a pattern that is most significant in the bands between 8-12 minutes from the school. There are very few structures built in the 0-4 minute band. One reason for this pattern

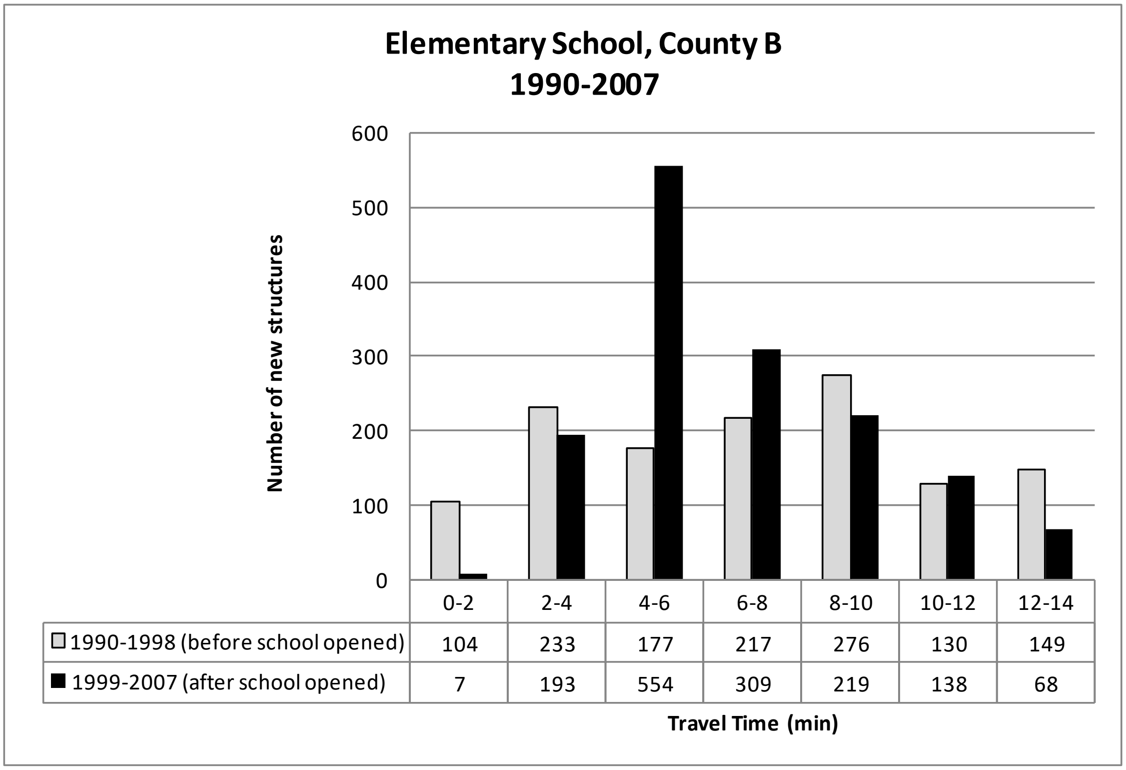
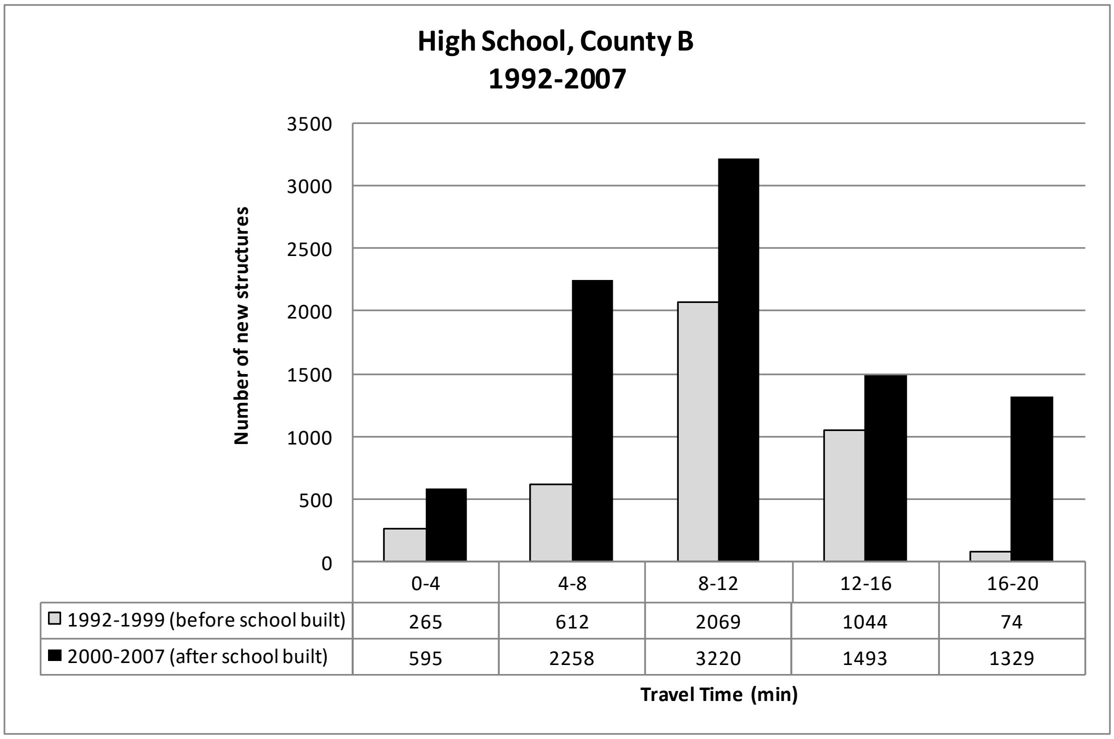


Figure 5.3. New Structures, County B, Elementary School

may be that since it is a high school site, the school is located farther away from an existing neighborhood. In most cases, due to the high traffic volume generated from a high school and the increased parking requirements, the school is located in an area that is not in a neighborhood.

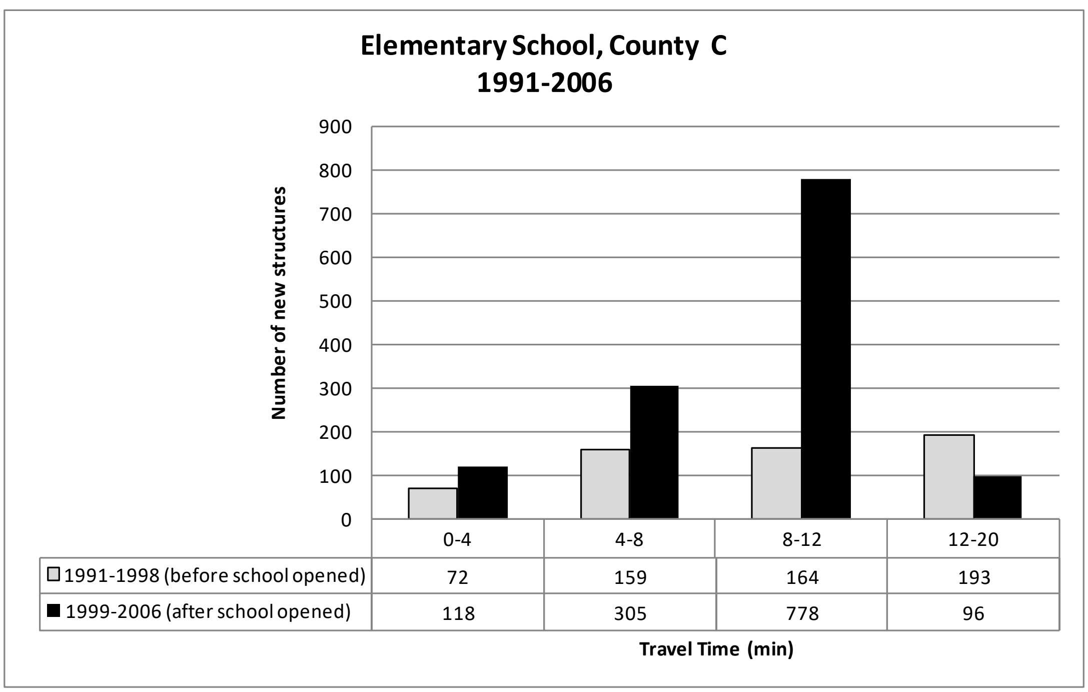
For the developing exurban counties, we see the same pattern for the elementary school, but a slightly different pattern for the high school. Figure 5.5 shows the elementary school and the pattern of fewer buildings within four minutes of the school and more going further away from the school until tapering off at 12-20 minutes. Development is significantly greater after the school opened for all bands except for those farthest away from the school. However, Figure 5.6 shows that the pattern is not as consistent for the high school. For the 12-16 minute contours the growth after the school was built is actually lower than previous to the construction. Otherwise the pattern remains consistent. Growth in the attendance boundary follows a pattern that is consistent with the other county types with growth tending to be in the middle range of travel times.

For the rural school districts, the pattern is not quite as clear. Figure 5.7 shows the elementary school growth patterns. In most travel-time bands, the growth increased, however not by as significant difference as seen in the other county types. Also the pattern of development occurring in a bell curve shape is not as pronounced here. Development seems to be somewhat evenly disbursed for all the travel-time zones except for the farthest away, where there is a slight decrease.



	0-4	4-8	8-12	12-16	16-20
1992-1999 (before school built)	265	612	2069	1044	74
2000-2007 (after school built)	595	2258	3220	1493	1329

Figure 5.4. New Structures, County B, High School



	0-4	4-8	8-12	12-20
1991-1998 (before school opened)	72	159	164	193
1999-2006 (after school opened)	118	305	778	96

Figure 5.5. New Structures, County C, Elementary School

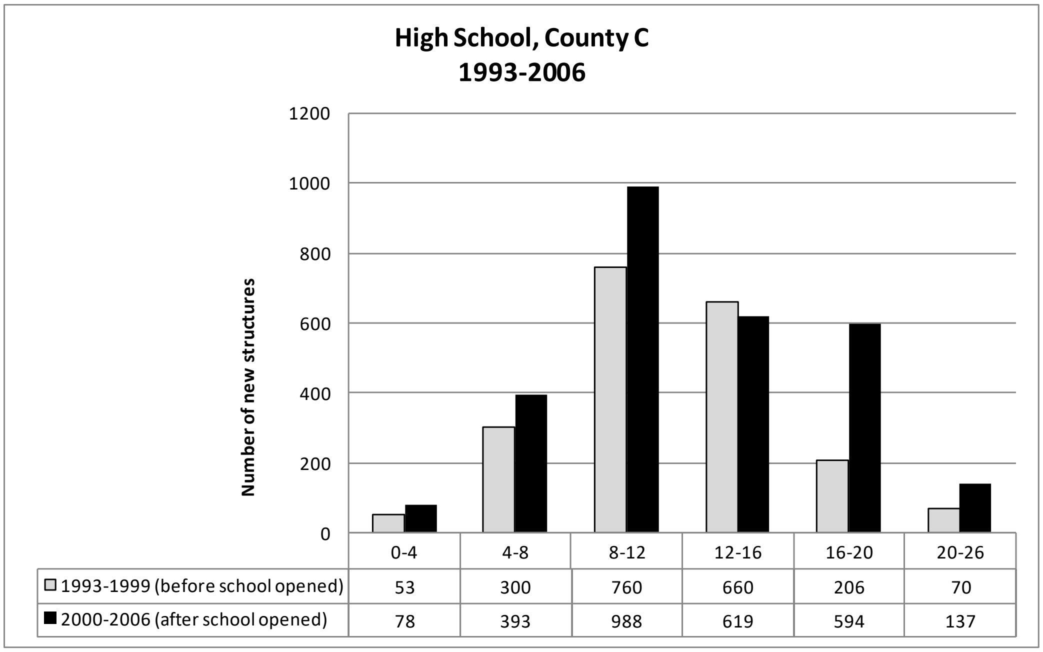


Figure 5.6. New Structures, County C, High School

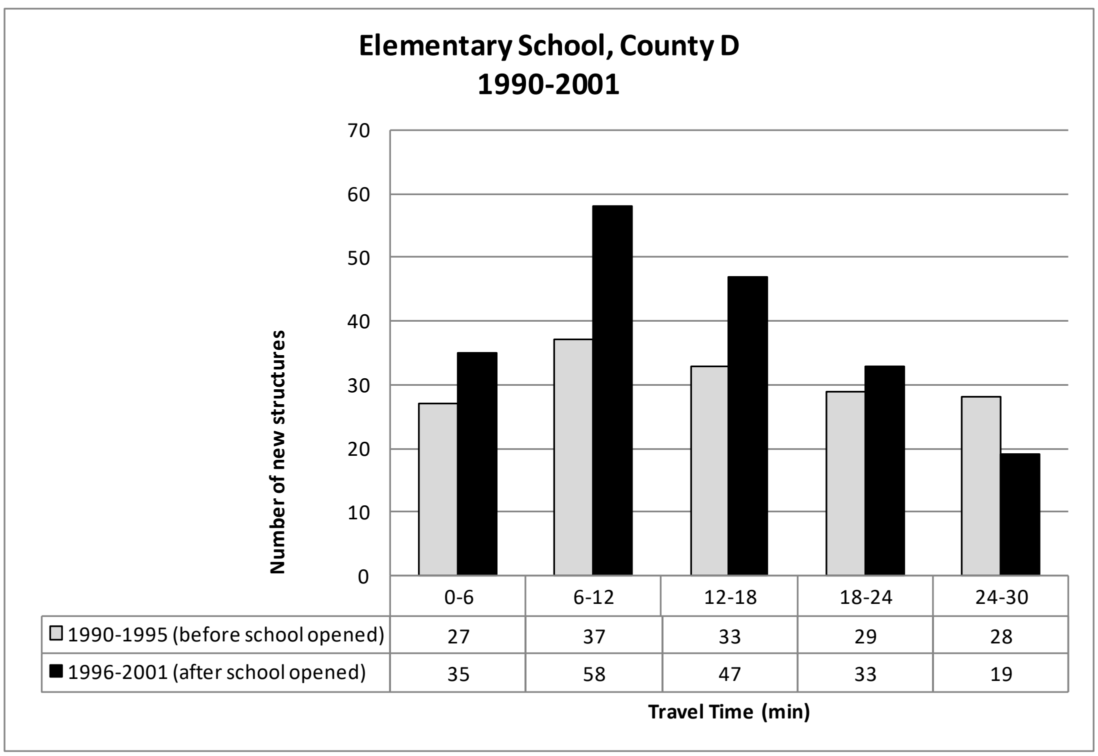


Figure 5.7. New Structures, County D, Elementary School

Figure 5.8 shows how the high school-related growth in the out years exceeds growth before the school opened in all except the 24-30 minute travel time band. The major difference between the growth patterns seen here and every other county is that the growth tends to be dispersed somewhat more evenly than seen before. This could be a result of less defined growth areas in a rural county where there is likely no sewer to most areas. When sewer access is limited, growth tends to happen sporadically and is not centered around a sewer line. Some of this could also be a result of the high school not impacting development patterns significantly. Prior to this high school, there was only one high school in the county. It is possible that there was a growth area that was previously served by the original high school and was intentionally brought into the school attendance boundary by way of redistricting when the school was opened.

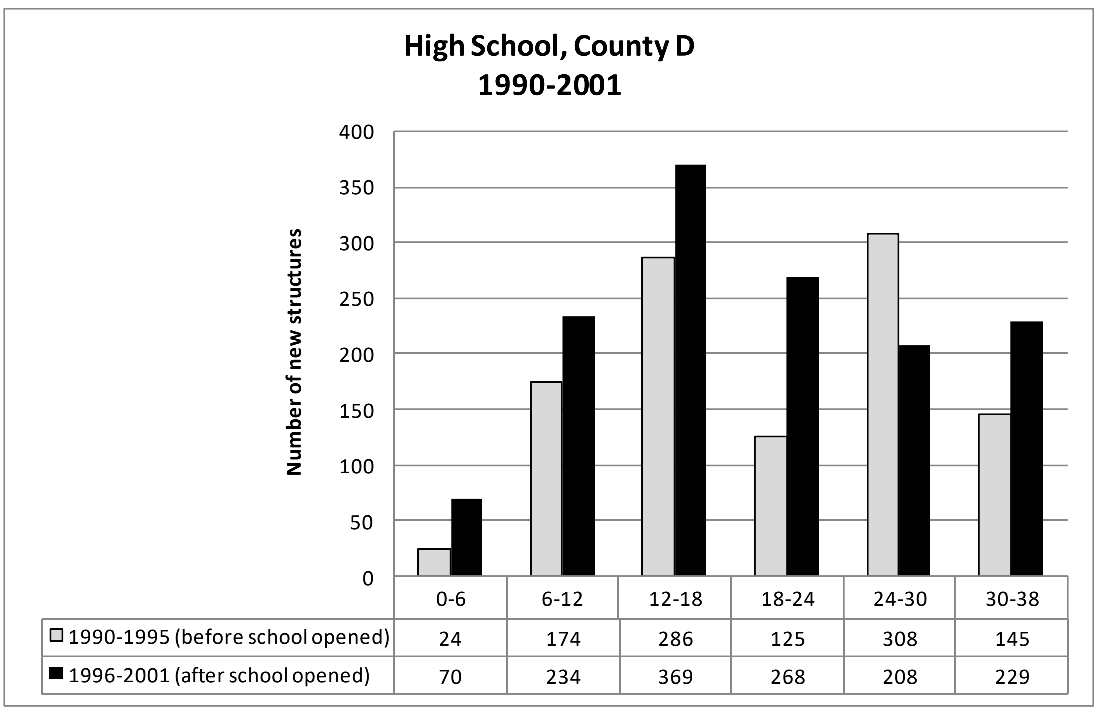


Figure 5.8. New Structures, County D, High School

5.3 Summary of Growth-Travel Time Analysis

A matrix was completed to summarize the relationship between pre- and post-school construction development in each of the eight schools. Table 5.4 provides a quick overview of the data presented in the previous tables. To summarize, the travel time contours were grouped into three groups and the factor of growth before the school was built to the growth after the school was built were calculated. In all cases except for the elementary school in the mature suburban county, growth increased after the school was built for the travel-time contours nearest the school site. In all cases except for the high school in the mature urban county, growth increased after the school was built for the travel-time contours in the mid-range. The results for the travel-time contours were mixed.

Table 5.4. Growth Pattern Summary Matrix

Elementary School

District Type	Close to school	Mid-Range	Far from school
Mature Urban	+	+	+
Mature Suburban	—	+	—
Developing Exurban	+	+++	——
Rural	+	+	—

High School

District Type	Close to school	Mid-Range	Far from school
Mature Urban	+	—	—
Mature Suburban	+++	+	+++
Developing Exurban	+	+	++
Rural	+	+	—

— pre-school development exceeded post-school development by a factor of 1.0 - 1.99
—— pre-school development exceeded post-school development by a factor of 2.0 - 2.99
——— pre-school development exceeded post-school development by a factor of 3.0+

+ post-school development exceeded pre-school development by a factor of 1.0 - 1.99
++ post-school development exceeded pre-school development by a factor of 2.0 - 2.99
+++ post-school development exceeded pre-school development by a factor of 3.0+

5.4 Traffic Counts Near School Sites

Traffic counts were used to determine the amount of traffic growth in a school attendance boundary over time. Figure 5.9 shows an example of a school attendance boundary with traffic count stations located in and around it. The traffic count locations within each school attendance boundary were selected and their associated data exported to Excel™. Further analysis was done to determine any travel patterns that could be easily seen. Elementary schools and high schools were analyzed separately.

Traffic levels did not fluctuate considerably for either the elementary school boundaries or the high school boundaries. Figures 5.10 and 5.11 show the Average Annual Daily Traffic (AADT)

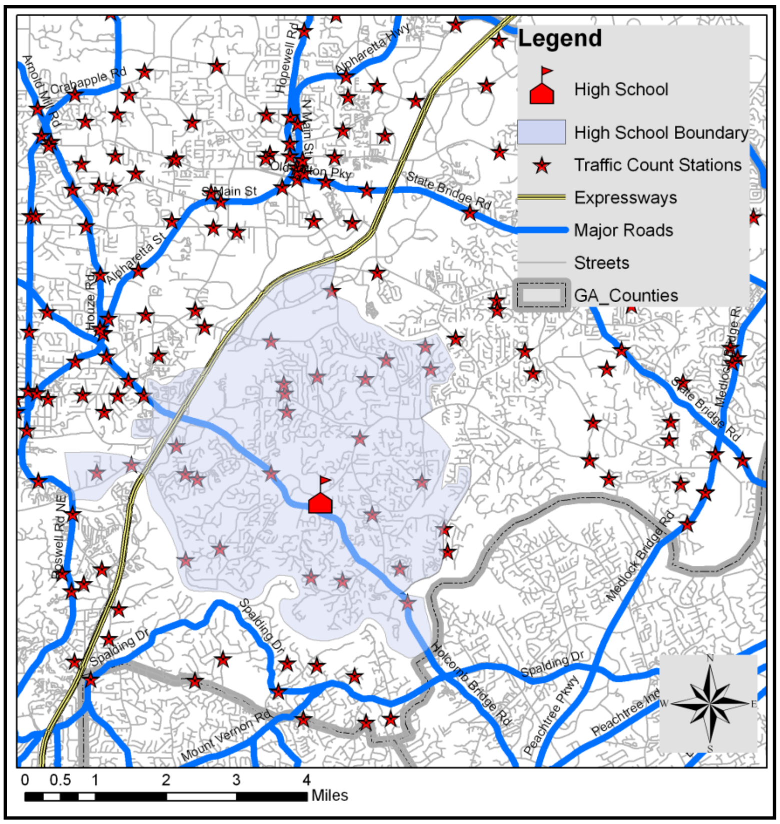


Figure 5.9. Traffic Count Locations

all of the valid points (those with no zero values) for years 1998-2007. The values are mostly flat; except for the mature suburban county (County B) elementary school which showed a gain from 4,900 to 8,400—almost doubling over the ten year time period—an increase of 71%. This only takes into account Average Annual Daily Traffic, and does not consider school peak hour as a separate measurement. Measures for specific sites around the school during peak hour were not available for this analysis. Further study could be done to measure the impact over time of schools on traffic, but that level of detail was not available for this study.

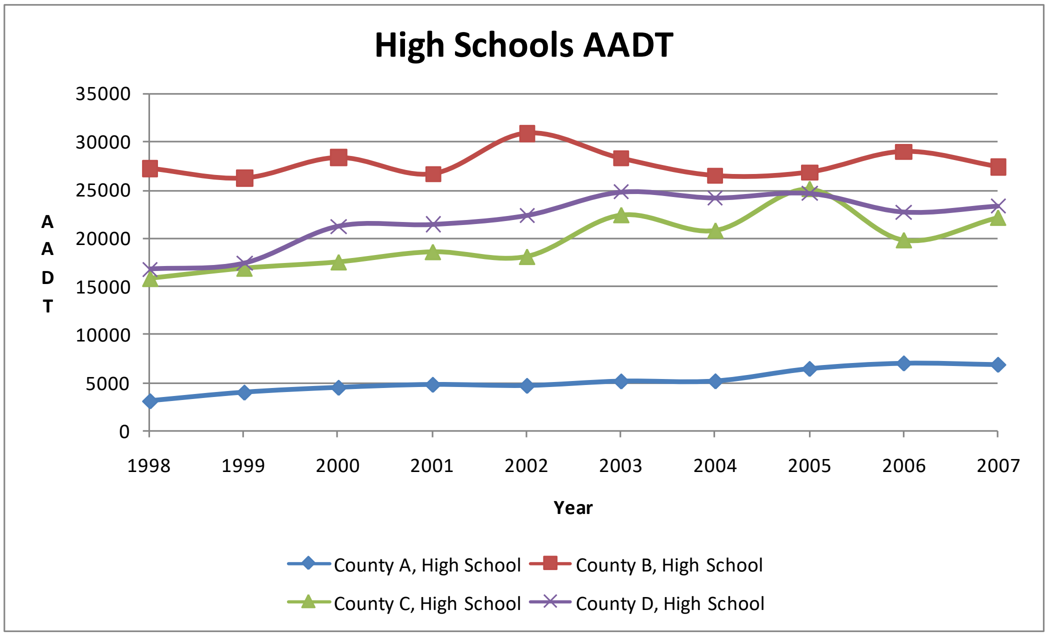


Figure 5.10. High Schools AADT

Figure 5.11. Elementary Schools AADT

5.5 Interview Results and Discussion

Seventeen interviews were conducted over a period of several weeks with school facility planners, school board members, and state educational facilities officials. The questions were aimed at determining the context in which school site decisions are made and identifying the institutional barriers to improving cooperation between school districts and local governments.

In Georgia, there is a fairly wide disparity between school districts that cooperate with local governments and those that do not. The interviews brought to light some of the issues that different types of communities face. This discussion addresses some of the issues raised in the interviews, including site size requirements, cooperation between county and school planners, school district view of renovation versus new construction, and overall challenges school districts face with regard to facilities. A summary of those responses are given here, but a detailed table of responses is given in **Error! Reference source not found.**.

In all counties interviewed, facility planners and school board members were asked to describe how the planning process worked in their district. Most commonly they gave a description of the five-year facility plan as required by GaDOE. This process includes looking at development patterns and projected land use and calculating the required space needed for the planned development. These factors are based on an average number of children per housing unit. Those projections are used as inputs to the existing educational facilities given the current attendance boundaries. When a school exceeds capacity, it is assumed that portable classroom units will take up the additional enrollment up to 120% of capacity. Then, a new school site must be found.

Most commonly, school sites are selected by simply choosing a point between two currently overcrowded schools. The district looks for land located geographically between the existing overcrowded schools and selects a site that has sewer access (or reasonable planned sewer service), adequate lot size, and adequate transportation facilities. In most cases, school districts wanted to avoid state highway routes as the main access point for the school because of problems getting traffic signalization warrants for the small peak hour generated by school traffic. Instead school districts tried to locate near a state route where a secondary arterial would serve as the main entrance for the site.

Most acknowledged that it was difficult to determine whether development led schools or if schools led development. The urban and suburban counties all had data-driven planning processes that projected where growth would occur and attempted to match school capacity with the anticipated growth. The exurban and rural districts, however, did not have a sophisticated method for school site selection and instead relied on site donations by developers and inexpensive land on the outskirts of existing neighborhood development.

Although there was no consensus about how development patterns occurred, there were several instances where facility planners suggested that practices relating to school siting did drive development patterns. Table 5.5 provides an example of some of the statements from the interviews. School facility planners' comments ranged from acknowledging that growth would follow anywhere the district chose to build a school to stating that linking local government planning with school planning was a primary goal.

Due to no state regulation in terms of who should be involved in school planning, collaboration occurred to a different degree in every county interviewed. To help frame the level of collaboration between municipal and county government with the school district, an evaluation framework was used. This framework was adapted from a paper by David Salvesen, Andrew Sachs, and Kathie Engelbrecht [51]. The framework consists of three levels along the "continuum of collaboration."

Table 5.5. Selected Quotes from Interviews

School Type	Quote
Developing Exurban	"If schools were allowed to collect impact fees, our primary funding source for school construction, the ESPLOST, would be very difficult to implement."
Developing Exurban	"We have lost a sense of community in this county. We recognize that a school location will shift development patterns from where they need to be."
Developing Exurban	"We want a 'live, work, play' community, but 'educate' is always left out."
Developing Exurban	"You can bet if I just went out in the middle of nowhere and built a school, within five years there would be development around it."
Developing Exurban	"We're normally out there first. There are no [community facilities] where we want to go."
Developing Exurban	"Every time we go out and buy a piece of land, we're putting a school out in a rural area by itself."
Developing Exurban	"School districts are chartered by the state constitution with their own governing bodies. County governments are chartered by the state constitution. They don't talk to one another very much. That is a symptom of the Home Rule provision in the state constitution. Sometimes staff wants to talk to each other, but their bosses—the elected officials—don't want them to."
Mature Suburban	"We build our schools so big, existing neighborhoods are not as important."
Mature Suburban	"We're not going to build neighborhood schools; it's just not economical."
Mature Urban	"Our goal is to link up what happens in the local government to school planning and siting."
Mature Urban	"Everything that happens in our county in terms of operations—where are the teachers, classrooms, when to build a new school—is directly linked to what is happening in municipal and county planning departments."
Rural	"The educational system is definitely what brings people to our county; you can eliminate any question about that."
Rural	"We build schools where we can spread out and the neighborhoods tend to grow up around the schools."
State Agency	"The playing fields and parking lots are the 'tail that wags the dog' in facility construction and site selection."

- **Level 1** describes a situation in which each entity (school board, county commission, municipality) conducts its business independently from the other with little or no coordination beyond what is required by law. In Georgia this describes a situation where school districts only communicate with GDOT (as required by law) when a school site is near a state route. Level 1 collaboration means that there is no necessary communication with the local government. Under this level, counties and municipalities would approve new subdivisions and the school districts would select new school sites independently. Decisions are made without any input from each other.

- **Level 2** describes a situation where each entity understands that there is more to gain by working together than independently. School districts retain full authority to select school sites, but consult with other entities before making final decisions. Occasional meetings are held between staff members, and on rare occasions between elected officials. Usually agreements are made through a Memorandum of Understanding (MOU). Many times this level of collaboration would occur as a final approval stage. That is, rather than communicating with each other as the decision process is advancing, communication would happen at final approval after the decision already has significant momentum.

- **Level 3** describes a situation where collaboration is institutionalized. Each entity retains autonomy and authority to achieve its objectives, but executes its mission in collaboration with other entities. Proposed subdivisions are analyzed for their impact on schools, and approved only if adequate capacity exists. Potential sites for schools are identified in local land use plans. A school board representative sits on the county commission as a nonvoting member when rezoning is on the agenda and county commissioners sit on school boards as nonvoting members when school facility planning is on the agenda.

Schools surveyed in this research varied among these three levels. A total of nine school districts were interviewed as part of this research. The research team ranked the school districts based on those responses. Only one school district received a *Level 3* ranking. This was the developed urban school district because of the partnership between the district and the county commission and municipalities it served. In this case, data about development decisions was made available to the school district, and the school facility planner developed site recommendations based on yearly reports from the county and municipalities.

Four of the districts received a *Level 2* ranking for their limited cooperation with county and municipal governments. Some districts had policies in place that provided that there would be a representative of the school board on the planning and zoning commission for the county. This was an effective policy in most districts, but one facility planner complained that this position only allowed access at the end of the application process. By the time the planning and zoning commission reviewed the application, there was already so much momentum that it was difficult to reject. The facility planner felt limited in his ability to influence and shape the development around the school, but was complimentary about the access to the knowledge that the development would be coming online.

Other school districts had policies in place to meet periodically with county and municipal officials. This occurred either on a monthly basis or quarterly. In all cases, the meetings were at the request of the school district and hosted by the school district. The facility planners felt that this was a workable solution to communicating regularly with county officials.

Four school districts were rated as *Level 1* because of the lack of consistent cooperation with the local government. These districts indicated that there was little communication between staff at the school district and staff at the local government. Furthermore, there was little communication between the elected officials at these organizations. In one case, where there was little communication between agencies, the staff expressed desire to collaborate, but was unable due to political differences between board level officials. This resulted in uncoordinated action on the part of the school board and the county commission and forced the school district to constantly take a reactive position.

5.6 Schools, Urban Development Patterns and Transportation

One of the common themes that came out of the interviews was the relationship between schools and development patterns. This is a circular pattern that is driven both by the schools themselves and by the municipality approving the subdivisions. Figure 5.12 illustrates the circular relationship. This is a simplification of the process by which developers, school districts, local government, and households relate to each other. It is important to note that these relationships are complex and involve much more than what is illustrated here, but the fundamental relationship is an accurate representation of the data collected in the interviews.

As local governments approve subdivisions and rezoning, school districts respond with planning new school facilities. In suburban and exurban settings where schools compete with housing for land, they often choose to locate on the fringe where land is least expensive. This

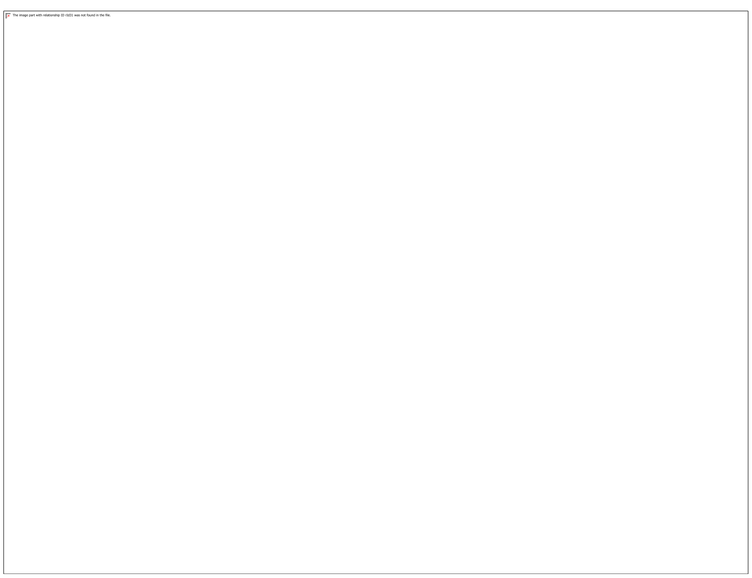


Figure 5.12. Relationship between Schools and Development

"frontier" leadership causes households to demand housing near the new school. Developers respond to this by creating new housing and applying for subdivisions which starts the cycle again. This pattern was confirmed through several interviews. School planners in districts where there was little cooperation with local government often felt as though they were always reacting to the decisions of the county commission on development.

Although school planning and transportation planning are usually conducted in entirely different contexts, it is important to note the intersection between school planning and transportation infrastructure. In 1969, when the first National Household Transportation Survey (NHTS) was completed, 48% of students walked or biked to school. When the 2001 NHTS was done, less than 15% of students walked or biked to school [52]. This significant decrease in walking to school has many observers concerned that the facilities built today do not allow for safe biking and walking. Interviews with facility planners confirmed that existing neighborhood infrastructure development is not a significant consideration when siting a school.

Research has shown that 7-11% of morning non-work trips occur as a result of school drop-offs (this figure is actually understated because it does not include trip chains that include a stop for a school drop-off, as those would be considered work trips) [53]. The question becomes how to address school planning in the context of transportation planning. Although GDOT is notified of school siting decisions statewide, usually there is no comment on the location unless the school would directly impact a state route. Interviews showed that in almost all cases, school districts avoid building schools where the direct access point is on a state route. Instead, schools are designed to accommodate all pick-up and drop-off traffic on-site and many do not have adequate pedestrian or bicycle access. In many cases, this leaves driving as the only safe transportation mode to school.

The interviews showed that school facility locations are primarily impacted by the residential development patterns (see Figure 5.13). Discussions with school officials also suggest there is a feedback loop in which school facility locations also impact residential development. If planners strive to have more effective smart growth policies, this feedback loop seems to be a critical point at which local government can influence land development patterns. By harnessing the feedback effect of school sites on residential development, local government can influence patterns of schools on development patterns and influence the growth through means of public provision of schools in already developed areas.

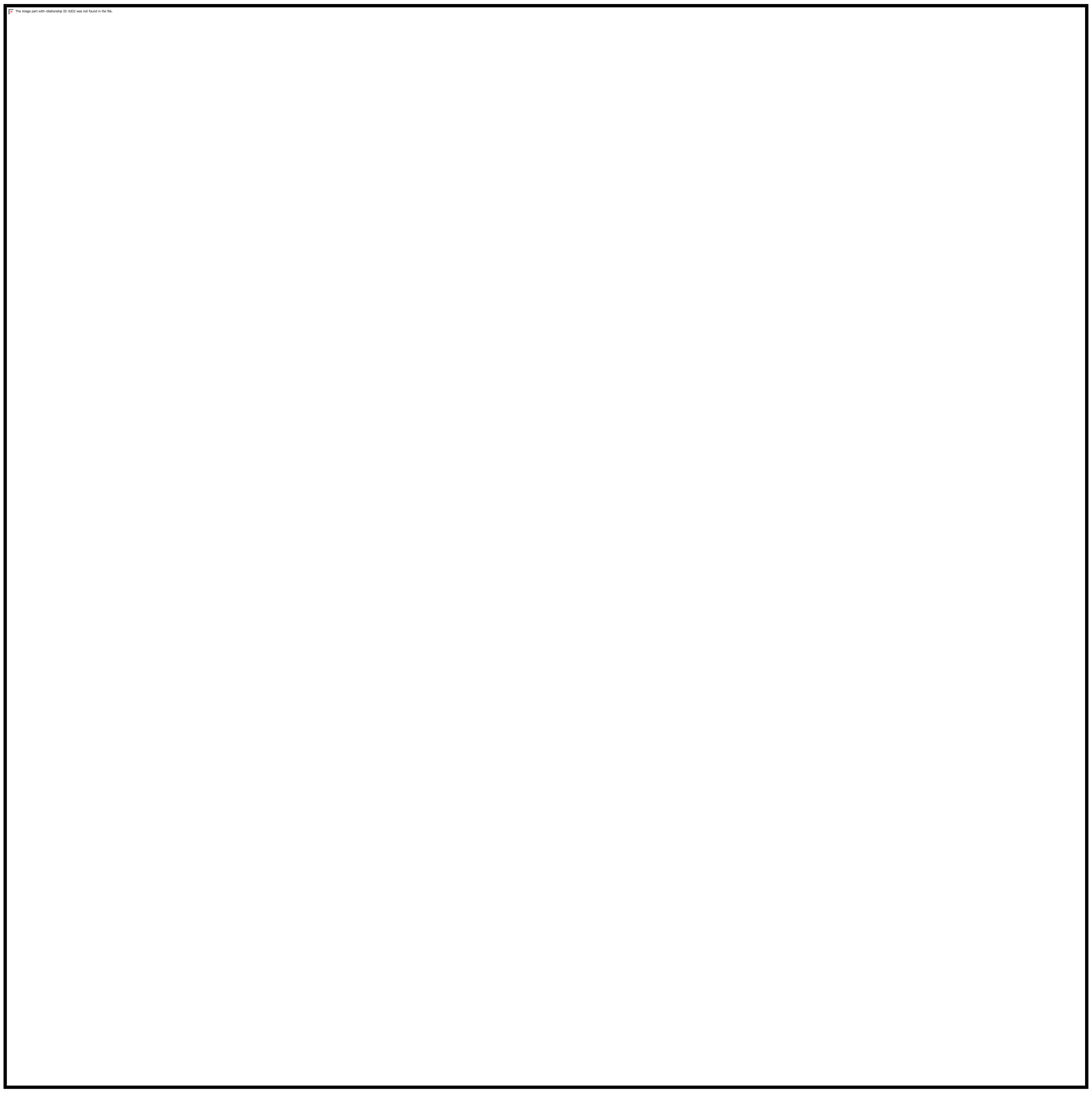


Figure 5.13. Linkages between Transportation and Development

5.7 Policy implications of land use and school siting decisions for the walking and bicycling environment

Through the school site analysis, it becomes obvious that land development and the decision for school siting affect each other and this interaction both directly and indirectly affects travel behaviors to school, particularly walking and bicycling because the use of these transportation modes depend on the appropriate provision of the infrastructure, such as sidewalks and bicycle lanes, for safety. The following policy implications can be derived from the analysis to improve walking and bicycling to school.

First, cooperation between land use planning, particularly for residential development, and school planning is essential to consider existing neighborhood infrastructure when school siting decisions are made. . In many instances, school sprawl and residential sprawl occur in a vicious circular process where a school is developed in fringe areas to take advantages of lower land values, and housing is developed around new schools, or vice versa. Since the predominant mode of travel in these areas is generally the automobile walking and bicycling trips are often not viable, safe or popular modes for students to travel to school. In addition, the dependency on cars in their early childhood may have a longer term effect on forming student's r transportation habits they carry into adulthood. The obvious benefits of walking and bicycling on obesity and physical activity are many.

Municipalities' comprehensive plans should incorporate an analysis of school capacity in estimating municipal growth. The information from this analysis could be used by planning departments, public work departments, departments of transportation, transit authorities and school districts to achieve a greater level of coordination when siting new schools. The plan also could also provide guidelines for sidewalks and bike lanes connecting residential areas to schools. Specific land use tools that may be considered include Adequate Public Facilities Ordinances (APFOs) and Urban Service Areas (USAs), also called Priority Funding Areas (PFA) in Maryland. While these tools do not directly address walking and bicycling environments, they indirectly promote such environments by directing new growth (including new schools) to existing urbanized areas or ensuring necessary infrastructure is appropriate and available in a community when and where growth occurs. With a concept similar to USAs, government entities can propose support for constructing pedestrian and biking facilities between schools and new subdivisions if the development takes place within the USAs. However, if developers want to build beyond USAs, it could be considered within a different cost structure. The requirement of adequate pedestrian facilities and bike lanes is important for new schools and new residential development because students are more likely to walk and bike when a higher quality built environment supportive of these modes exists.

The minimum acreage requirements for schools should be reconsidered to encourage greater flexibility. This change will provide school districts seeking candidate sites for new schools with more available land within existing urbanized areas where there are typically fewer large scale vacant site that are affordable. Also, the change will encourage school districts to build smaller schools which may reduce average walking time and distance from housing to school by reducing its catchment area. This may readily result in an increasing willingness to walk and bike to schools.

Finally, additional transportation policies can help increase walking and bicycling. Campaigns for walking and bicycling to schools, such as Safe Routes to School (SRTS), can be an effective tool to increase safety and encourage walking and bicycling in existing communities. In addition, increasing parking fees and reducing parking capacity within high school campuses may encourage students to use alternative transportation modes.

5.8 Summary

The analysis on the sample of eight schools provided statistical evidence indicating there is a relationship between the time that the school was built and the growth rate around the school.

The chi-square statistic showed that there was evidence to suggest that school location had some impact on the growth pattern surrounding the site. The degree of causality leaves some question as to whether the schools caused the growth or if the school was simply a response to the growth already occurring. However, several interviewees stated that one of the primary marketing tools their chamber of commerce uses is the quality of the schools in their district. Therefore, it is possible that the *quality* of the schools is more of a driving force of development, and the physical location simply determines where the growth will occur. This suggests that a quality school in an already developed area may cause growth in a similar manner.

Chapter 6: SCHOOL AND TRANSPORTATION FUNDING IN GEORGIA: AN EXAMINATION OF SPLOSTs

This chapter examines sales tax referenda results from Georgia to analyze the voters' propensity to support both school and transportation taxes. It is increasingly important to understand the extent to which and the conditions under which counties, cities, states and other governmental entities support the finance of infrastructure. This can be examined through the level of public indebtedness, and their propensity to support splosts, tax change or financial policy under different financial alternatives or scenarios. It can also be examined through the modal lens and or a preference for particular technologies. Lastly, it is important to understand how support for the finance of infrastructure varies by socioeconomic status. While the information identified above is important to the successful development and implementation of public policy this study was more narrowly tailored. Three specific research questions were investigated here:

1. What has been the success rate of SPLOSTs for both schools and transportation?
2. Does the financing of education projects through SPLOSTs work against the funding of transportation projects?
3. What are some of the main factors affecting the results of transportation and education SPLOSTs?

6.1 Introduction to School Capital Finance

School capital finance differs greatly throughout the United States. Some states, such as Missouri, Nebraska, and Oklahoma, prefer to leave the capital financing up to the individual school districts and local governments and only provide funding for operational expenses. Other states, like Georgia, New Jersey, and Maryland, actively participate in capital funding programs [54]. Georgia's capital program is called the Capital Outlay Program. This source of funding provides school districts a maximum of $200 million each year statewide for improvements and new construction to school facilities. Each year, these funds are authorized in the state budget from the general fund.

Funding is provided for four types of capital improvements: a) new construction, b) renovation of existing facilities, c) addition to existing facilities, and d) modifications (i.e. HVAC, roofing). In each case a local match is required. Funding is based on a ratio of need in a given school district versus need on a statewide basis. Districts with faster growth receive proportionally more than districts that have slow or no growth.

To be eligible for funding from the state, each school district must have a five year facility plan that includes projections for enrollment and available facility space in the district. The five-year plan must also include any plans to consolidate or divest any facilities. The funding structure is separated into four categories: a) regular entitlement funds, b) regular advanced funding, c) exceptional growth funds, and d) low wealth funds. These four funding pools are separated to ensure that funds for schools in rapidly growing districts do not consume all of the state funding for schools and leave other slower-growing districts behind. The separate funding pools also protect the low wealth districts from being unduly left out of the funding pool.

Entitlement funds are determined by a ratio of individual district need to statewide need. Each district is allocated an amount determined by the entitlement ratio. From this point, districts can choose to speed up the construction process by supplementing the state funds with local funding (many times from the ESPLOST), or wait until the annual authorization has accumulated enough to fund the construction project. The state will fund at the level specified in Table 6.1.

Table 6.1. Georgia State Funding Levels for Regular Classrooms (IU)

Category	**New Construction**	**Additions**
Elementary	\$71/sq. ft 1,800 sq. ft. per IU	\$71/sq. ft 750 sq. ft. per IU
Middle	\$73/sq. ft 2,200 sq. ft per IU	\$71/sq. ft 660 sq. ft. per IU
High	\$75/sq. ft 2,850 sq. ft. per IU	\$71/sq. ft 600 sq. ft. per IU

Source: Georgia Dept. of Education Facilities Division
*Note: IU = Instructional Unit (one classroom equivalent)

Exceptional growth funds are reserved for districts that have at least 1 ½ percent annual growth and add at least 65 students each year. The exceptional growth funding in almost all cases is used in metro Atlanta school districts, because this is one of the only areas of the state growing at a rate fast enough to qualify. Exceptional growth funds are set aside separate from the regular funding pool.

Capital outlay funds can be accrued year over year, which allows the school district the flexibility to choose when to match the local dollars with state dollars to initiate a capital project. Because of the limits on what the state will fund (see Table 6.2), usually the school district must come up with additional funds to supplement the state funds. Rarely is the \$71 to \$75 per square foot allowance enough to actually construct a facility [55]. In addition, capital outlay from GaDOE may only be used for the building itself. Local funds must be used for land acquisition, athletic facilities, parking, and any other site improvements other than the instructional space.

Renovations are also funded by the Georgia Department of Education. Renovation funds are available after the school is 20 years old and are available at \$12,000 per instructional unit (IU). Renovation funds from the state are only available once per building. If an entire school building is being renovated, the state will only provide funding if the total cost of renovation does not exceed 50% of the replacement cost for the same number of instructional units [56].

Table 6.2. illustrates some of the renovation and planning requirements from selected states. Some states do not have maximum renovation funding while others set maximum funding levels at 65% of replacement cost.

Table 6.2. Funding and Planning Policies for Selected States

State	Funding for Capital School Improvements	Planning Requirements	Other
Arizona	When renovation exceeds 65% of replacement cost, state recommends new construction	No requirement to comply with zoning law	
California	No position on renovation vs. new construction	Schools and counties required to meet if one party request. Legislation requires schools districts and county planning officials to work closely on school siting	Set aside $50M of the total state capital budget for schools for joint-use facilities
Colorado	Renovation discouraged when cost exceed 65% of replacement cost	Board of Education must inform the local governing body of the proposed site	
Connecticut	Neutral on renovation vs. new construction	None	Local share of school funding must be approved by the town
Florida	$332M budgeted for construction and renovation in 2002-03	School board and governing body "shall agree on a process for assuring coordination with local, regional, and state governmental agencies to assure compatibility with comprehensive plans."	
Georgia	$200 million annually for school capital construction. When renovation cost exceeds 50% of replacement cost, state funds are not available.	School districts *are* required to meet local zoning laws. 5-year facilities plan required. No special requirements for community outreach, but 5-year plans are approved at public board of education meetings	Educational Special Local Option Sales Tax is an option on a county-wide basis in all Georgia Counties.
Maine	Neutral with respect to new construction vs. renovation. State has revolving loan fund to finance renovation projects	Requires superintendents to work with the State Planning Office when making decisions regarding new sites. Encourages districts to: a) avoid sprawl, b) consider renovation or expansion, c) analyze sites for proximity to established neighborhoods, and d) select sites served by adequate roads	
Maryland	Favors renovation over new school construction consistent with the Maryland Smart Growth Policy. 80% of state school construction funding is spent on existing schools	Planning requirements include: a) discouragement of sprawl development, b) located in developed areas or locally-designated growth area, c) served by water, sewer, and other public infrastructure	Maryland has some of the strongest planning policies of any state with regard to schools
Massachusetts	Will reimburse up to 100% of replacement cost for renovations	No consistency requirement between school facility planning and general land use planning	
New Jersey	All facilities considered to be suitable for rehab unless a pre-construction evaluation determines otherwise	School districts required to file long range school facility plans with local planning boards	
Pennsylvania	Provides same level of reimbursement to renovations and new construction	Districts must comply with local zoning codes. Districts must also conduct school facility studies prior to obtaining state funding	Eliminated the 60% rule in 1998, so that renovations could be funded at the same level as new construction

Source: Nat'l Trust for Historic Preservation [57]

6.2 Experience with Sales Tax Referenda in Georgia: Background and Methodology

Georgia counties can use a general-purpose Local Option Sales Tax (LOST), a Special Purpose Local Option Sales Tax (SPLOST), and an Education Special Purpose Local Option Sales Tax (ESPLOST) to levy a one percent sales tax to support operations and/or capital expenditures. As a way of financing local capital projects, such as roads, streets, bridges, storm water, and drainage, the Special Purpose Local Option Sales Tax (SPLOST) law was enacted in 1985. The SPLOST is defined as "an optional one percent county sales tax used to fund capital outlay projects proposed by the county government and participating qualified municipal governments" [58]. As SPLOST revenues could not be used to build local schools, Education Special Purpose Local Option Sales Tax (ESPLOST) legislation (O.C.G.A. § 48-8-110) was enacted in 1996 along with a subsequent constitutional amendment (Article VIII, Section VI, paragraph IV) in 1997. This allowed local boards of education to call for SPLOSTs specifically for education capital projects [59]. While both SPLOSTs and ESPLOSTs are used only for capital outlay projects, the general Local Option Sales Tax (LOST), enacted in 1975, allows counties to issue a one percent general purpose sales to support operations [60, 61]. In this study, "SPLOSTs" represents all of the local option sales taxes presented above.

SPLOSTs were authorized in Georgia to help local governments cope with a lack of capital funds, and voter refusal to approve new property taxes. As of 1997, all but 10 counties in Georgia had used a SPLOST; by the mid-2000s, all but eight counties had used it [62]. These SPLOSTs had provided new capital revenue, but had not reduced long-term debt or provided relief to property tax burdens. Instead, Jung [45] asserted that SPLOSTs had led to a slight shift in finance strategy from general obligation to revenue bonds, and a slight decrease in property tax millage rates, but not in property tax receipts. In fact, per capita property tax payments increased slightly. SPLOST counties had higher per capita capital expenditures than non-SPLOST counties and capital expenditures not surprisingly were higher as a percentage of total outlays. Also, new capital investments over time resulted in more demand for operations and maintenance funding, most often paid from general funds. Due to possible fungibility between general funds and SPLOST funds, Jung expected that an additional dollar of SPLOST funding would result in an increase in capital spending that was less than a dollar. Jung calculated that each dollar of SPLOST revenue resulted in a 50-cent increase in total spending, of which 38 cents was capital spending and 12 cents was operational spending. SPLOST revenue as a percent of total revenue ranged from six to 40 percent, according to the Georgia Department of Community Affairs (DCA) data from 1994 [45].

This research used data on SPLOSTs collected from the Georgia Secretary of State's Office (http://sos.georgia.gov/cgi-bin/SalesTaxElectionsIndex.asp). The data included 493 sales tax referenda introduced between 1985 and 1997 (representing the period during which only the general purpose LOST and non-school capital SPLOST were active) and 721 sales tax referenda for 159 Georgia counties introduced between 1998 and 2009 (representing the period during which all SPLOSTs were active). The primary focus of this paper was on analyzing the period when all SPLOSTs were active. This is due to the fact that limited information on the SPLOST purpose (transportation vs. miscellaneous) is electronically available before this period; obtaining this information requires searching through paper archive documents which is left for future research. Among the 721 sales tax referenda introduced from 1998 to 2009, 678 referenda passed and 43 failed. This data was combined with other county level variables to examine the relationships between education and transportation SPLOST referenda. The detailed information of these election results is described below.

The trends for Georgia SPLOST election results between 1998 and 2009 were analyzed using descriptive analysis for the 721 election results. Specifically, the election results were examined to identify geographical variances in the results, adoption rates for different types of referenda, and the interaction of education and transportation related referenda votes on a county-by-county basis.

The relationship between the election results and the characteristics of counties were also examined using correlation analysis. The 721 election results were converted into county level data, creating a 159 (county) by 138 (variables) matrix. The election results were analyzed in three different ways. First, the aggregate number of adoptions (and rejections) by purpose of the referenda was calculated for each county. These variables measured how often each county used SPLOSTs for financing its capital projects. The average percentage of voters who approved (and rejected) referenda by purpose of the referenda was calculated for each county. Regardless of election results (pass or not), these variables measured how much voters were willing to support or reject the referenda. Finally, the amount of funds approved (and rejected) by purpose of the referenda was estimated for each county. This latter factor was a surrogate for the scale of projects proposed in each county. The examination is based on tax proposals that were put before the public. These were not generally attempts to measure the public's willingness to finance infrastructures under combinations of different modes, technologies, levels of financial indebtedness etc.

While a correlation analysis with the county level data can identify major factors associated with the election results, it cannot measure how these factors affect individual voting results. Multiple regression analysis was used to identify the main factors affecting election results and measure the impacts of the passing of education SPLOSTs on the approval of transportation SPLOSTs and vice versa.

SPLOST data were combined with other variables that could affect the success or failure of referenda and election results. Diverse factors, including home ownership, population over age 65, retail tax base, voter turnout [63], urbanization, interstate highways [64], and race [65], were hypothesized to be associated with the sales tax referenda results. To incorporate this additional information into the dataset, geographic and built-environment characteristics in the context of regional spatial structure, socio-demographic factors, economic variables, and transportation and infrastructure information were aggregated by county (see Table 6.3).

The election results for transportation and education referenda were analyzed separately. The primary purpose of this analysis was to measure the interaction of different purposes for SPLOSTs, particularly between transportation and education purposes. In fact, other purposes may have an even more significant relationship. Since few instances included both transportation and education referenda occurring at the same time, it was difficult to measure their interaction directly with the existing election results. Instead, new variables, which represented the pre-existence of other SPLOSTs at the time when new SPLOSTs were voted on, were created to measure how existing SPLOSTs affected voters' decisions on newly proposed SPLOSTs for transportation or school capital projects.

The following linear regression relationships were used:

$$\begin{aligned} TRANSYR_i = f(&EDU\_TRANS_i, TRANS\_TRANS_i, CAPITAL\_TRANS_i, ETC\_TRANS_i, \\ &SPLOST_i, GEO_i, DEMO_i, ECON_i, INFRA_i) \end{aligned} \quad (1)$$

Where i refers to an individual referendum proposed for transportation purposes and TRANSYRi is a dependent variable, representing the percentage of voters who supported transportation referendum i. EDU_TRANSi is an independent variable, representing a remaining period (months) of an existing education SPLOST when voters decided on transportation referendum i, TRANS_TRANSi is the remaining period (months) of an existing transportation SPLOST, CAPITAL_TRANSi is the remaining period (months) of an existing capital outlay SPLOST, and ETC_TRANS_i is the remaining period (months) of an existing miscellaneous SPLOST. *SPLOST* includes other election related variables, such as the period of the proposed SPLOST, the amount of proposed funds per capita, turnout rate, and years from 1996 when school districts were allowed to use SPLOSTs. GEO represents the characteristics of geography, regional spatial structure, and built environment. *DEMO* and *ECON* includes demographic and economic characteristics, respectively, and *INFRA* represents transportation and infrastructure related variables.

$$\begin{aligned} EDUYR_j = f(&TRANS\_EDU_j, EDU\_EDU_j, CAPITAL\_EDU_j, ETC\_EDU_j, \\ &SPLOST_j, GEO_j, DEMO_j, ECON_j, INFRA_j) \end{aligned} \tag{2}$$

Where j refers to an individual referendum proposed for education purposes. $EDUYR_j$ is a dependant variable, representing percentage of voters who supported a j education referendum. $TRANS\_EDU_i$ is an independent variable, representing a remaining period (months) of an existing transportation SPLOST when voters decided on the j education referendum, EDU_EDU_j is a remaining period (months) of an existing education SPLOST, $CAPITAL\_EDU_j$ is a remaining period (months) of an existing capital outlay SPLOST, and ETC_EDU_j is a remaining period (months) of an existing miscellaneous SPLOST.

Table 6.3. Variables and Data Sources for SPLOST Analysis

Variables		Source
SPLOSTs	Election results by purposes	Georgia Secretary of State's Office
	Amount of fund by election results	Georgia Secretary of State's Office
	Ratio of voters with approval or reject	Georgia Secretary of State's Office
	Funding period	Georgia Secretary of State's Office
	Registered voters	Georgia Secretary of State's Office
	Turnout ratio	Georgia Secretary of State's Office
Geography and built environment	Metropolitan area (dummy)	U.S. Census Bureau
	Metropolitan central county (dummy)	U.S. Census Bureau & ESRI
	Metropolitan suburban county (dummy)	U.S. Census Bureau & ESRI
	Rural county (dummy)	U.S. Census Bureau & ESRI
	Area (square miles)	ESRI
	Ratio of vacant housing units	U.S. Census Bureau
	Population density (2000)	U.S. Census Bureau & ESRI
	Ratio of homeowners	U.S. Census Bureau
	Ratio of renters	U.S. Census Bureau
Socio-demographic	Population	U.S. Census Bureau
	Ratio of population with age under 5	U.S. Census Bureau & ESRI
	Ratio of population with age between 5 and 17	U.S. Census Bureau & ESRI
	Ratio of population with age over 65	U.S. Census Bureau & ESRI
	Ratio of married couples with children	U.S. Census Bureau & ESRI
	Ratio of Asian	U.S. Census Bureau & ESRI
	Ratio of White	U.S. Census Bureau & ESRI
	Ratio of Black	U.S. Census Bureau & ESRI
	Ratio of Hispanic	U.S. Census Bureau & ESRI
	Educational attainment (high school)	U.S. Census Bureau
	Educational attainment (College or above)	U.S. Census Bureau
Economy	Employment (2000-2009)	Woods & Poole
	Per capita Income (2000-2009)	Woods & Poole
	Median income (White)	U.S. Census Bureau
	Median income (Black)	U.S. Census Bureau
	Median income (Asian)	U.S. Census Bureau
	Median income (Hispanic)	U.S. Census Bureau
	Retail earning (2000-2009)	Woods & Poole
	Per capita retail earning (2000-2009)	Woods & Poole
	Retail sale (2000-2009)	Woods & Poole
	Per capita retail sale (2000-2009)	Woods & Poole
	Poverty rate (White)	U.S. Census Bureau
	Poverty rate (Black)	U.S. Census Bureau
Transportation and infrastructure	Interstate highway length	ESRI
	Highway length	ESRI
	Ratio of commuters by car	U.S. Census Bureau
	Ratio of commuters by transit	U.S. Census Bureau

6.3 Analysis of Referenda Results

This section analyzes the SPLOST referendum data before and after the 1997 constitutional amendment allowing education SPLOSTS. An analysis of Georgia one percent sales tax referenda votes for the period 1985-1997 shows 493 votes held with 411 passing for a total pass rate of 83% (see Table 6.4) [66]. A Chi-Square test confirms that these pass rates are significantly different between the two periods at the 0.001 level ($\hat{\chi}^2 = 36.1 >> \chi^2_{1,0.001} = 10.8$).

Table 6.4 - SPLOST Referenda Results, 1985-2009

	Total 1985 - 1997	**Total 1998-2009**
Total	411	678
N	82	43
%Y%	83.4%	94.0%

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1985–2009.

Individual year pass rates ranged from 59% to 94% (see Table 6.5). There was an average of 38 referendum votes taken per year in the state during this time period.

From 1998 to 2009, a total of 721 SPLOST referenda were held in Georgia. This was an average of 60 per year. However, when education votes were removed (n=347), the average was 31 referenda per year. This is less than the 38 per year average found between 1985 and 1997, implying that fewer non-education referenda were held in Georgia in the time period since education SPLOST referenda were allowed. Of the 721 referenda on the ballot from 1998 to 2009, 678 passed and 43 failed for an overall 94% pass rate, higher than the 83.4% seen in the previous period. When education votes are taken out, the pass rate was 92.9%, also higher than the previous period (see Table 6.6). When the 1998 to 2009 referendum votes are segmented into metro counties, non-metro counties, education votes and transportation-related votes[1], passage rates range from 91% to 96% (see Table 6.7). Additionally, on a year-by-year basis, referendum votes in the 1998-2009 period had a higher pass rate than did those in the 1985-1997 period (see Figure 6.1). The years in red represent the number of years after the passage of the 1985 SPLOST for infrastructure and the years in blue represent the number of years after the passage of Education SPLOST in 1997.

Table 6.5. SPLOST Referenda Results, 1985 - 1997

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Y	26	25	36	19	30	27	30	42	39	42	39	29	27
N	8	17	6	8	5	11	2	7	3	3	2	5	5
%Y	77%	60%	86%	70%	86%	71%	94%	86%	93%	93%	95%	85%	84%

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1985–1997

Table 6.6. SPLOST Referenda Results, 1998-2009

	Yes	No	% Yes
Metro	297	28	91.4%
Non-metro	381	15	96.2%
Transportation	237	18	92.9%
Education	332	15	95.7%

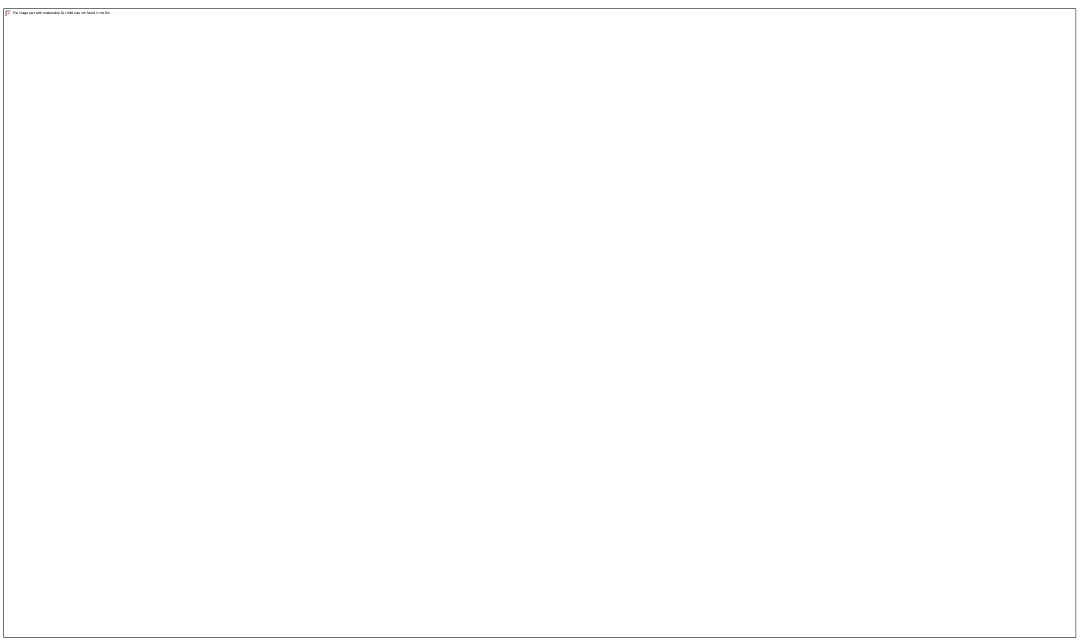
Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009

[1] For this analysis, referenda that included transportation elements were treated as transportation referenda.

Table 6.7. SPLOST Referenda Results, Metro and Non-Metro

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Metro	Y	13	21	16	41	30	30	19	22	35	32	23	15
	N	3	2	3	4	3	2	3	2	1	3	0	2
	% Y	81%	91%	84%	91%	91%	94%	86%	92%	97%	91%	100%	88%
Non-Metro	Y	14	22	36	51	40	25	21	50	47	33	23	19
	N	2	0	3	2	1	0	0	2	0	1	2	2
	% Y	88%	100%	92%	96%	98%	100%	100%	96%	100%	97%	92%	91%
Total	Y	27	43	52	92	70	55	40	72	82	65	46	34
	N	5	2	6	6	4	2	3	4	1	4	2	4
	% Y	84%	96%	90%	94%	95%	97%	93%	95%	99%	94%	96%	90%

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009



Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Records, 1985–97, 1998-2009.

Figure 6.1. Yearly SPLOST Pass Rates by Analysis Period

Pass rates for 1998 to 2009 time period were analyzed based on metro/non-metro status[2] and also based on the purpose of the referendum (e.g., education, transportation). From 1998 to 2009, metro area pass rates ranged from 81% to 100%, non-metro area pass rates ranged from 88% to 100% (see Table 6.8).

Over the same time period, a total of 347 education referenda were held with 332 passing and 15 failing. Pass rates for education referenda in both metro and non-metro areas ranged from 83% to 100% (see Table 6.9). Figure 6.2 shows the percent of voters that supported a school referendum.

A total of 255 transportation referenda were held between 1998 and 2009, with 237 passing and 18 failing. Pass rates in metro areas for transportation referenda ranged from 50% to 100% and in non-metro areas ranged from 88% to 100% (see Table 5.14 and Figure 6.3).

Table 6.8. SPLOST Referenda Results, Education

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Y	Metro	5	7	2	27	18	12	5	8	23	23	7	8
	Non-Metro	5	8	9	31	20	8	6	23	30	20	10	17
	Total	10	15	11	58	38	20	11	31	53	43	17	25
N	Metro	1	1	1	1	1	0	0	0	0	1	0	0
	Non-Metro	1	0	1	1	1	0	0	1	0	0	2	2
	Total	2	1	2	2	2	0	0	1	0	1	2	2
%Y	Metro	83%	88%	67%	96%	95%	100%	100%	100%	100%	96%	100%	100%
	Non-Metro	83%	100%	90%	97%	95%	100%	100%	96%	100%	100%	83%	90%
	Total	83%	94%	85%	97%	95%	100%	100%	97%	100%	98%	90%	93%

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009

[2] Metro counties are those that fall within a census designated metropolitan area. All others are considered non-metro.

Table 6.9. SPLOST Referenda Results, Transportation

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Metro	1	3	6	7	5	17	3	10	10	8	12	4
Y	Non-Metro	8	7	17	15	10	14	3	22	12	12	9	2
	Total	9	10	23	22	15	31	6	32	22	20	21	6
N	Metro	1	0	2	2	1	1	1	1	0	2	0	1
	Non-Metro	1	0	2	1	0	0	0	1	0	1	0	0
	Total	2	0	4	3	1	1	1	2	0	3	0	1
%Y	Metro	50%	100%	75%	78%	83%	94%	93%	91%	100%	80%	100%	80%
	Non-Metro	89%	100%	90%	94%	100%	100%	100%	96%	100%	92%	100%	100%
	Total	82%	100%	85%	88%	94%	97%	96%	94%	100%	87%	100%	86%

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009

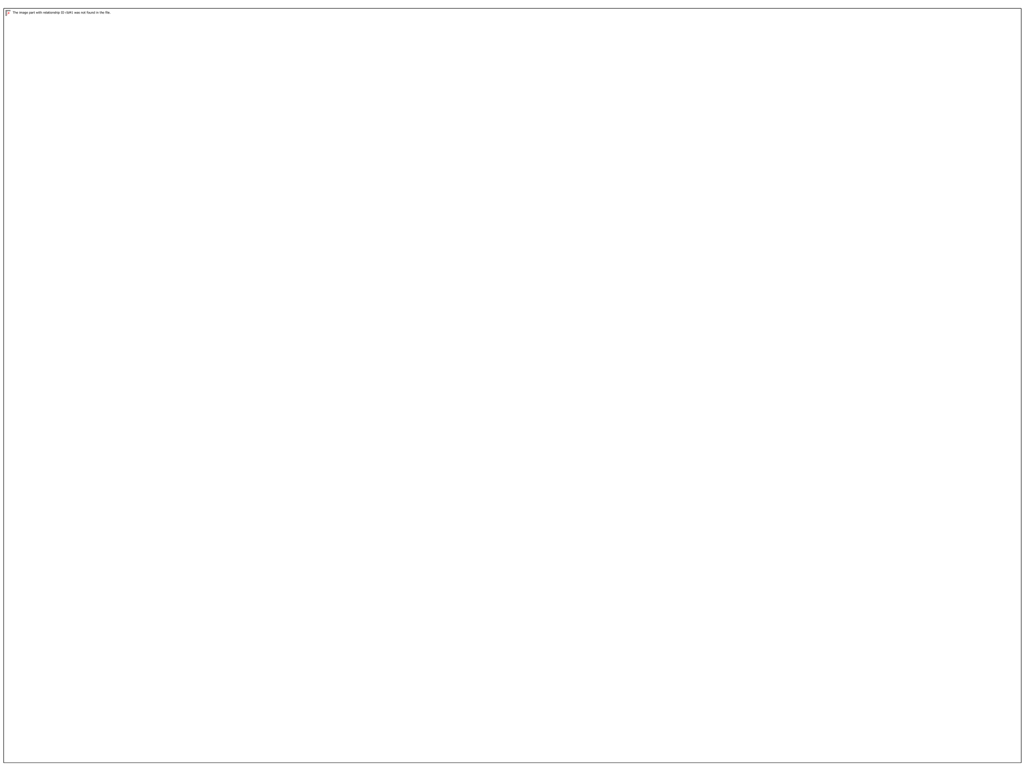


Figure 6.2. Average Ratio of Voters Who Supported SPLOST Referenda for Education, 1998-2009

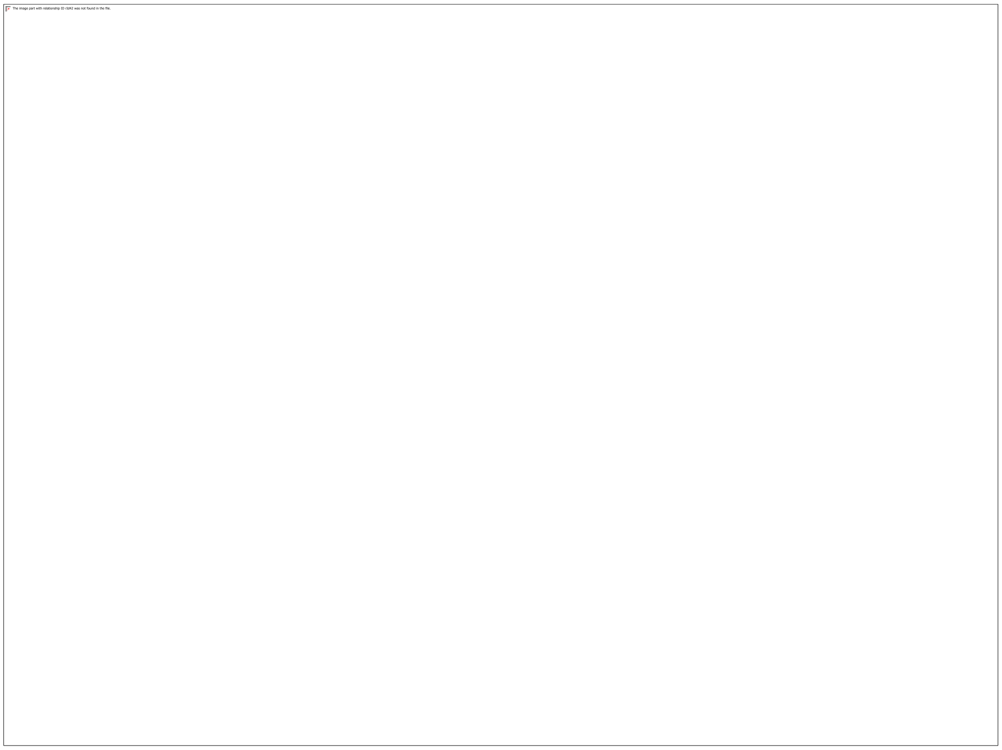


Figure 6.3. Average Ratio of Voters Who Supported SPLOST Referenda for Transportation, 1998-2009

The SPLOST referenda results were further analyzed to determine if there were statistically significant relationships in a referendum's likelihood to pass based on other factors (e.g. metro vs. non metro, education vs. transportation, voter turnout) [3].

Metro Counties versus Non-Metro Counties **-** The election results were cross-tabulated with metro/non-metro area being the independent variable and passage of the referendum as the dependent variable. In metro areas 91.4% of the referenda passed; in non-metro areas 96.2% passed (see Table 6.6). Although both metro and non-metro areas saw high rates of passage, Chi-Square tests confirm that the metro-non metro differences are significantly different at the 0.01 level ($\hat{\chi}^2 = 7.42 > \chi^2_{1,0.01} = 6.6$) with referenda being more likely to pass in non-metro areas;

[3] For the statistical analysis, two of the 721 original records were removed from the dataset due to incomplete information. Both of these records were for educational votes in rural counties. The removal of these two records did not change the results of the analysis.

however, the correlation of the two variables was very weak (Pearson's correlation coefficient = 0.114, p = 0.002).

Education Referenda versus Transportation Referenda - The range in percentage of transportation referenda passed (82% to 100%) is similar to that of education referenda (83% to 100%) (see Tables 6.8 and 6.9). Chi-square tests confirm that across all counties, there pass rates for transportation and education referenda are similar ($\hat{\chi}^2 = 2.12 < \chi^2_{1,0.05} = 3.84$). However, when only looking at metro regions, the range for transportation referenda (50% to 100%) is larger than that for education referenda (67% to 100%). In both cases, the low value in the range comes in a year when few votes were held (n=2 for transportation and n=3 for education).

To further explore the relationship between transportation related and education referenda an analysis was conducted controlling for the metro or non-metro designation of the county. Within metro counties 88.9% of the transportation referenda passed while 96% of the education referenda passed. Chi-Square tests confirm that the difference in pass rates within metro counties are significantly different at the 0.05 level ($\hat{\chi}^2 = 4.96 > \chi^2_{1,0.05} = 3.84$); however, the correlation was very weak (Pearson's correlation coefficient = 0.138, p = 0.026). Within non-metro counties there was no significant difference in pass rates between transportation referenda (95.9%) and education referenda (96.4%).

6.4 Characteristics of Counties with Election Results

This section examines the dataset to reveal which variables are related to election results at the county level. Individual election results consisting of 721 1% sales tax referenda between 1998 and 2009 are combined with county level data. As a result, the dataset includes information of election results for each county along with the characteristics of their geography and built environment, socio-demography, economy, and transportation variables.

Election results are measured in three different ways: frequency of passed or failed referenda, ratio of voters who approved or rejected referenda, and the amount of funds approved or rejected by voters.

6.4.1. Frequency of election results by purposes

The frequency of passed or failed referenda shows where 1% local sales taxes are used to finance transportation and education projects between 1998 and 20009. For example, figures 6.4 and 6.5 show that more than half of the counties that did not pass transportation referenda during the same period are located within metropolitan areas, including five central counties in the Atlanta, Columbus, Macon, and Valdosta metropolitan areas, while frequencies of passed referenda for education purposes are evenly distributed across the state.

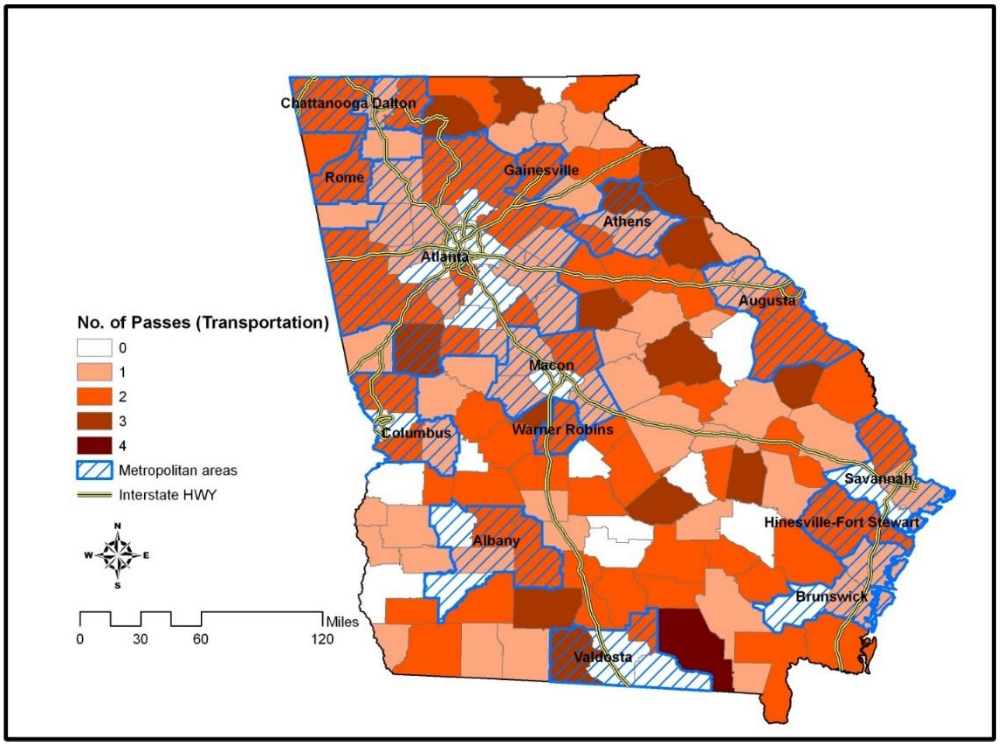


Figure 6.4 - Frequency of passes for 1% local sales tax referenda for transportation

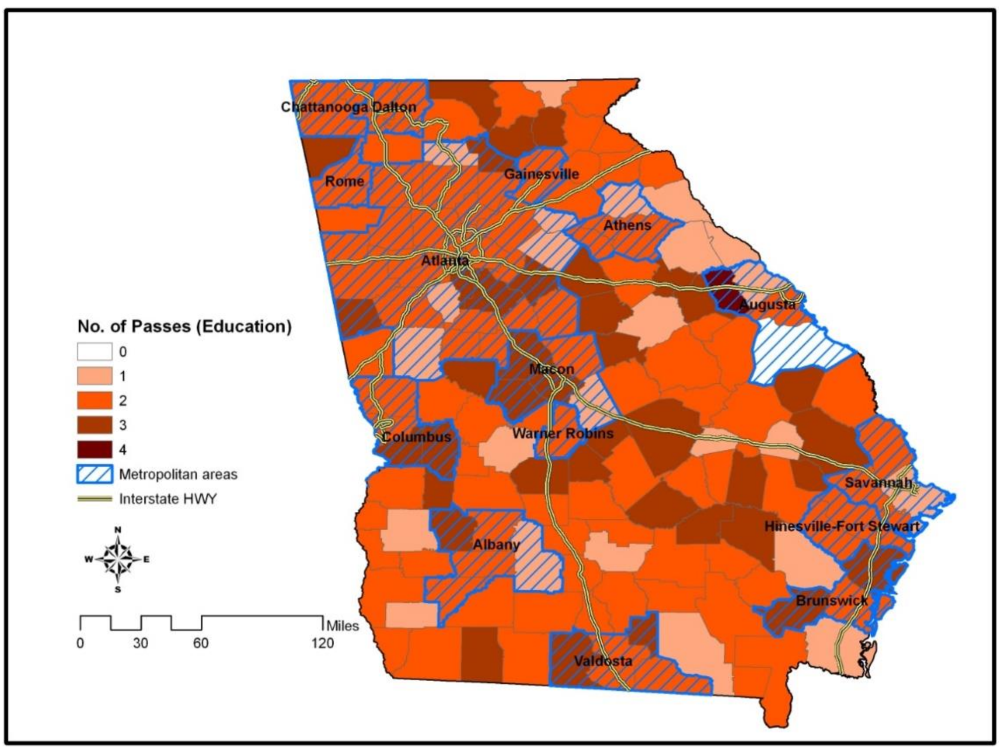


Figure 6.5 - Frequency of passes for 1% local sales tax referenda for education

Table 6.10 - Correlation results between the number of election results by purposes and associated factors

Factors		Number of "Yes" Election Results (#)			Number of "No" Election Results (#)		
		All purposes	Transport	Education	All purposes	Transport	Education
Voting	Transportation (# of "yes" results)	0.380***					
	Education (# of "yes" results)	0.633***			-0.368**		
	Turnout ratio				0.365**		0.827***
Geography	Rural county (1,0)		0.173**				
	Area (square miles)		0.152*				
Demography	Population (2000)	-0.139*				0.638***	
	Registered voters (1998)	-0.146*				0.662***	
	Population density (2000)					0.517**	
	Population with age over 65					-0.481**	0.461*
	College or above attainment ratio					0.202**	
Economy	Poverty rate (White)				-0.202**		-0.175**
	Per capita Income ($,2000)					0.503**	
	Median income (White)				0.213***	0.202**	
	Median income (Black)				0.244***	0.288***	
	Retail earning ($,2000)	-0.137*				0.683***	
	Per capita retail earning ($,2000)		-0.143*			0.672***	
	Retail sale ($,2000)					0.684***	
	Per capita retail sale ($, 2000)		-0.143*			0.569**	
Transportati-on	Interstate highway length	-0.215*	-0.244*				
	Highway length					0.506**	
	Railroad length	-0.142*					
	Commute by car ratio					0.157**	
	Commute using transit ratio	-0.186**	-0.234***				

Note: Only statistically significant variables are presented; *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level

Table 6.10 presents the correlation results between the frequencies of election results by purposes and county characteristics that are statistically significant.

Both education and transportation purposes are highly correlated with the frequency of passes. The turnout ratio is correlated with the frequency of rejected referenda, which is partly consistent with Jung's results [67]. Specifically, a correlation coefficient of the turnout ratio and the frequency of rejections for education purposes is 0.827, significant at the 1% level. This means that the rejections for education referenda have occurred mostly in counties where the turnout rate is high, while this result does not hold in the frequency of rejected transportation referenda.

As 12 metropolitan counties, including 4 counties in the Atlanta region, did not have transportation referenda passed between 1998 and 2009, rural counties (0.173) and the size of counties in square miles (0.152) are positively correlated with the passes of transportation referenda. Similar results are found with demographic variables. For example, counties with higher population, registered voters, population density, and education attainment that are typical characteristics of metropolitan counties, have experienced higher rejections with transportation referenda. An interesting result with demographic variables is that population with age over 65 is positively correlated with the rejection of educational referenda. This makes sense because there is no strong reason why aging people support education referenda in that their children may not be in school ages any more.

An unexpected result is that most economic variables are negatively related to the pass of 1% local sales tax referenda. Instead, they have higher positive correlations with the rejections of the referenda, particularly for transportation purposes. For example, per capita income, the amount of retail earnings and retail sales are positive to the rejection of transportation referenda, and their correlation coefficients are 0.503, 0.683, and 0.684, respectively. These results may be due to the fact that higher values of economic variables are found in metropolitan areas where there are existing federal level transportation funds and more diversified parties who sometimes have different interests and priorities in investments, for example transportation versus education. However, further research should be conducted to examine these issues.

A similar interpretation can be made on the results with transportation variables of which values tend to be higher in metropolitan areas rather than in rural areas.

6.4.2 Likelihood to pass referenda by purpose

While the frequency shows whether the referenda passed or not, the ratio of responses measures how much voters support the referenda to finance local projects. Except those counties with no transportation referenda passed, the results of both transportation and education referenda are evenly distributed (Figures 6.6 and 6.7). The only distinction in the results of transportation referenda is that neighboring counties of the central county in the Atlanta metropolitan area, including Cobb, Fayette, and Henry counties, have lower average ratio of supporting transportation referenda with less than 50% support, and the ratios of support increase as the distance from the central county increases.

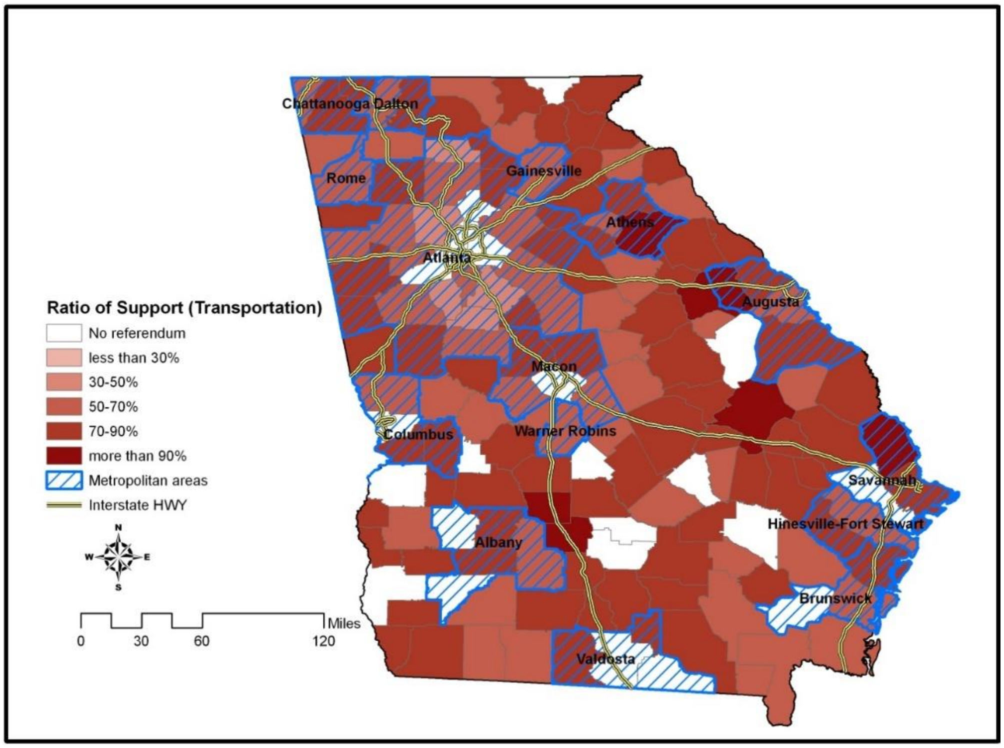


Figure 6.6 - The average ratio of voters who supported 1% local sales tax referenda for transportation

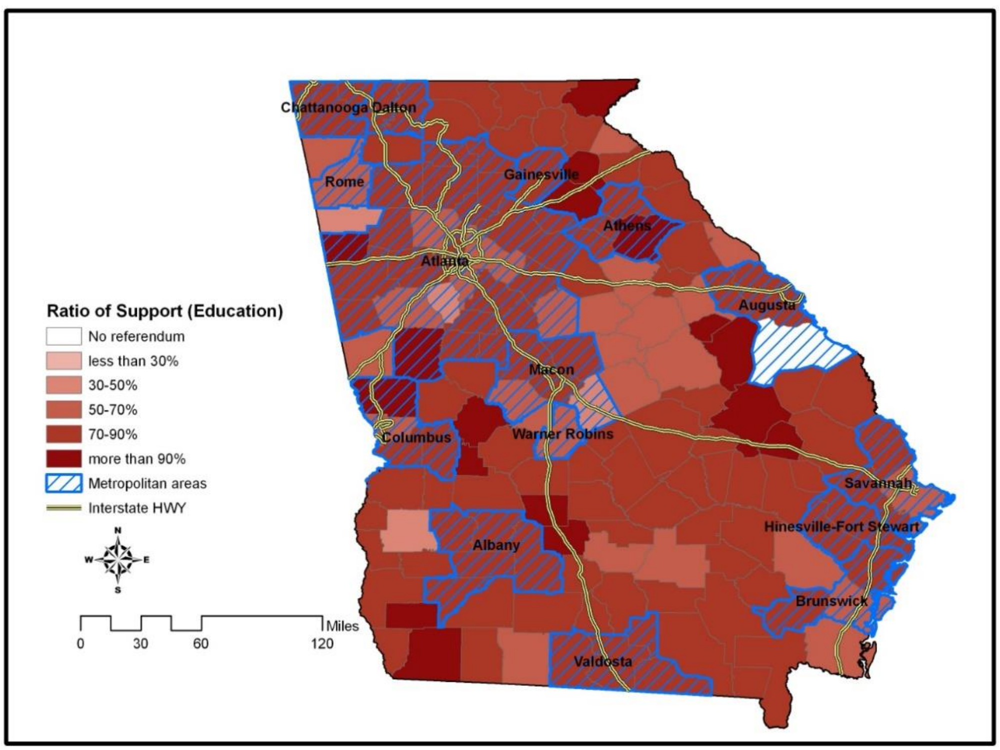


Figure 6.7 - The average ratio of voters who supported 1% local sales tax referenda for education

Table 6.11 - Correlation results between the ratio of voters by purposes and associated factors

Factors		Ratio of "Yes" Voters (%)			Ratio of "No" Voters (%)		
		All purposes	Transport	Education	All purposes	Transport	Education
Voting	Transportation (ratio of "yes" voters)			0.463***			-0.463***
	Education (ratio of "yes" voters)		0.463***			-0.463***	
	Capital (ratio of "yes" voters)		0.307**	0.321**		-0.307***	-0.321***
	Transportation (approved fund)		-0.270***			0.270***	0.152*
	Education (approved fund)		-0.287***			0.287***	0.164**
	Turnout ratio	-0.497***	-0.369***	-0.484***	0.497***	0.369***	0.484***
Geography and built environment	Metropolitan area (1,0)	-0.227***	-0.230***		0.227***	0.230***	
	Metropolitan central county (1,0)	-0.265***	-0.202**	-0.265***	0.265***	0.202**	0.199**
	Rural county (1,0)	0.227***	0.176**	0.174**	-0.227***	-0.176**	-0.174**
	Ratio of vacant housing units	0.182**	0.184**		-0.182**	-0.184**	
	Population density (2000)	-0.318**	-0.377***	-0.318***	0.318***	0.377***	0.247***
	Median house old					-0.216***	
Demography	Population (2000)	-0.264***	-0.331***	-0.264***	0.264***	0.331***	0.210***
	Registered voters (1998)	-0.254***	-0.331***	-0.254***	0.254***	0.331***	0.207***
	Population with age over 65	0.175**	0.174**		-0.175**	-0.174**	
	Married couples with children		-0.151*			0.151*	
	Ratio of Asian	-0.280***	-0.288***	-0.280***	0.280***	0.288***	0.192**
	Ratio of White			0.170**			-0.170**
	Ratio of Black						0.153*
	Ratio of renters	-0.136*			0.136*		
	High school attainment ratio	0.207***		0.159**	0.207***		-0.178**
	College or above attainment ratio	-0.284***		-0.156*	0.284***	0.205***	0.232***
Economy	Poverty rate (White)	0.255***		0.264***	-0.255***		-0.286***
	Poverty rate (Black)			-0.132*		-0.238***	
	Per capita Income ($,2000)	-0.277***	-0.322***	-0.277***	0.277***	0.322***	0.195**
	Median income (White)	-0.329***		-0.203**	0.329***	0.249***	0.236***
	Median income (Black)	-0.332***		-0.131*	0.332***	0.358***	0.190**
	Median income (Hispanic)					0.200**	
	Retail earning ($,2000)	-0.224***	-0.296***	-0.224***	0.224***	0.296***	0.176**
	Per capita retail earning ($,2000)	-0.293***	-0.246***	-0.293***	0.293***	0.246***	0.223***
	Retail sale ($,2000)	-0.256***	-0.308***	-0.216***	0.256***	0.308***	0.200**
	Per capita retail sale ($, 2000)	-0.216***	-0.160*		0.216***	0.160**	0.163**
Transportati-on	Interstate highway length			-0.307**			0.307**
	Highway length	-0.164**			0.164**		
	Railroad length	-0.188**		-0.214***	0.188**		0.214***
	Commute by car ratio	-0.135*			0.135*	0.259***	
	Commute using transit ratio	-0.150*	-0.300***	-0.149*	0.150*	-0.148*	0.174**

Note: Only statistically significant variables are presented; *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level

Overall, the results of correlation analysis between the ratio of voters' responses and county characteristics are similar to those when analyzed with the frequencies of election results (Table 6.11). Several distinctions are as follows.

The ratio of voters who supported transportation referenda is highly and positively correlated with that of education referenda. For example, their correlation coefficient is 0.463 and significant at the 1% confidence level. This coefficient is higher than those of capital outlay purposes with transportation and education purposes. They are 0.307 and 0.321, respectively. Although those ratios of voters are county averages, and most referenda were single issues rather than multi-issue referenda, the results show at least that counties that pass transportation referenda have high probabilities of passing education referenda. The question about what happens if both transportation and education referenda are on the same ballot is addressed in the next section.

Counties with higher ratios of Asians and married couples with children show negative correlation with the ratio of supports for transportation referenda.

6.4.3 The amount of approved funds by purpose

The frequency of passes and the ratio of support do not capture the scale of projects proposed through 1% local sales tax referenda. As seen from Figures 6.8 and 6.9, the distribution of approved funds, which are assumed to be proportionate to the scale of projects, looks different from the results of the frequencies and the ratios presented in Figures 6.4 through 6.7.

For example, non-metropolitan (or rural) counties tend to have higher frequencies of passes and ratios of support for both transportation and education referenda. However, when those numbers are translated into the amount of money, metropolitan counties appear to be the highest holders of 1% local sales tax finances for both transportation and education purposes. Particularly, counties in the Atlanta metropolitan area maintain a higher amount of funds from the 1% local sales tax. From these results, it would be concluded that metropolitan counties tend to have large scale projects funded through 1% local sales tax, while redundant small scale projects may not be proposed through this finance source.

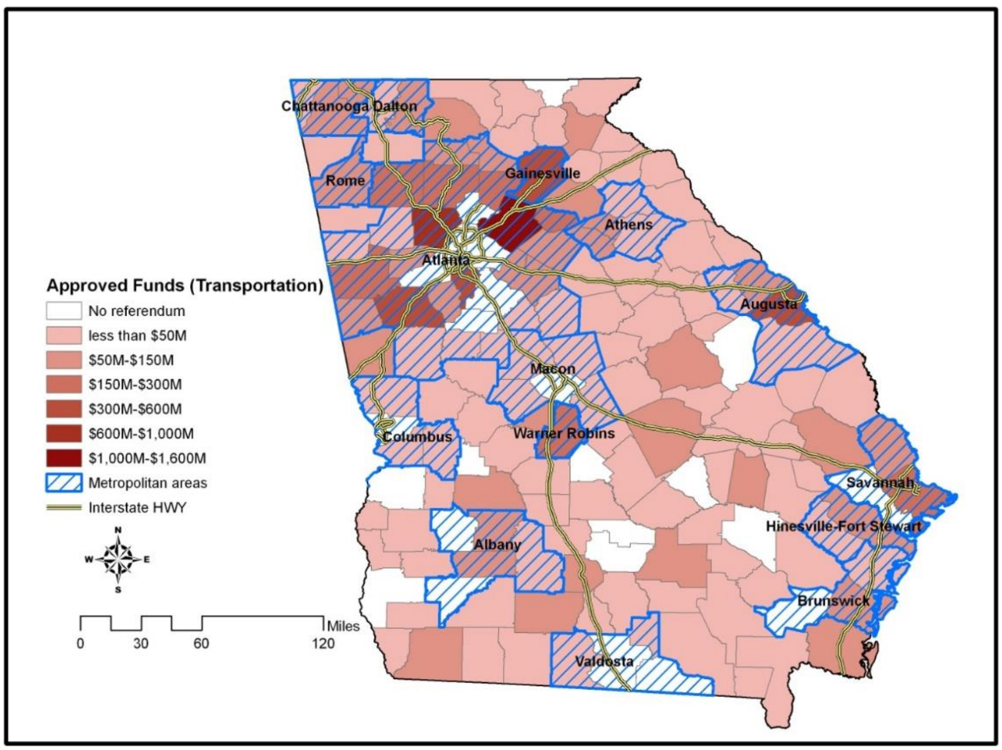


Figure 6.8 - The total approved funds for transportation purposes between 1998 and 2009 through 1% local sales tax referenda

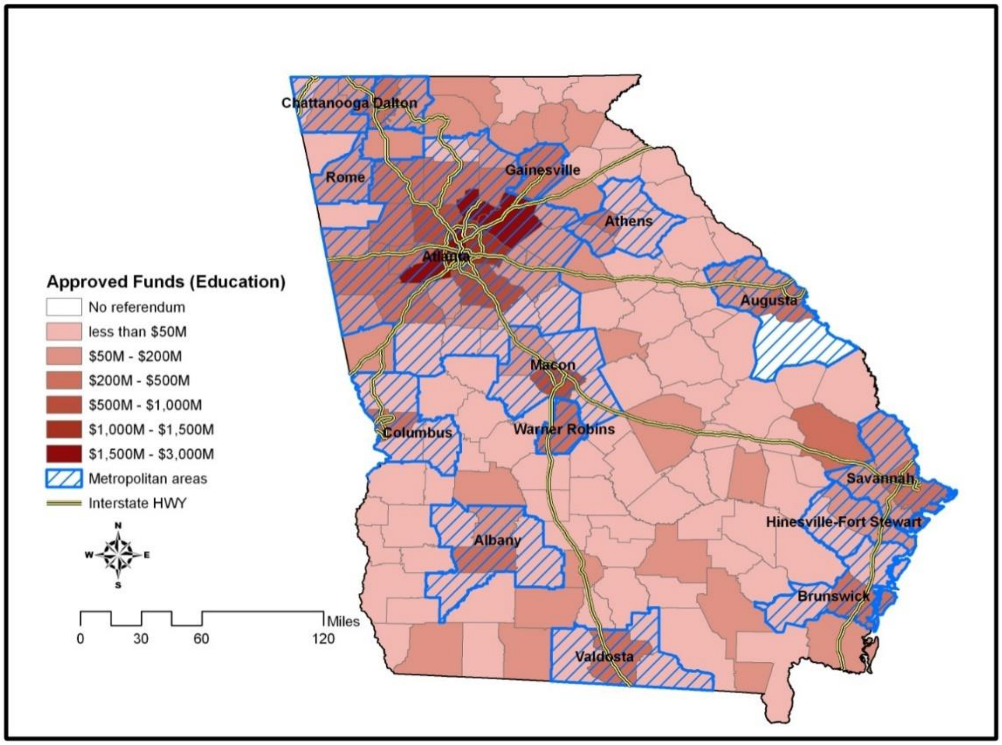


Figure 6.9 - The total approved funds for education purposes between 1998 and 2009 through 1% local sales tax referenda

Table 6.12- Correlation results between the amount of funds by purpose and associated factors

Factors		Total Approved Funds ($)			Total Rejected Funds ($)		
		All purposes	Transport	Education	All purposes	Transport	Education
Voting	Transportation (ratio of "yes" voters)	-0.280***	-0.270***	-0.287***	-0.499***		-0.497*
	Education (ratio of "yes" voters)	-0.192**	-0.152*	-0.164**			
	Capital (ratio of "yes" voters)	-0.378***	-0.306**	-0.383***			
	Transportation (approved fund)	0.98***		0.968***	0.789***	0.883***	0.860***
	Education (approved fund)	0.978***	0.968***		0.732***	0.791***	0.917***
	Turnout ratio		0.194**				
Geography and built environment	Metropolitan area (1,0)	0.355***	0.326***	0.318***	0.500***	0.547**	0.804***
	Metropolitan central county (1,0)	0.461***	0.294***	0.434***	0.460***	0.613**	0.618**
	Metropolitan suburban county (1,0)		0.165*				
	Rural county (1,0)	-0.271***	-0.254***	-0.238***	-0.324*		
	Area (square miles)				-0.325*		
	Ratio of vacant housing units	-0.319***	-0.310***	-0.286***	-0.457***	-0.568**	-0.580**
	Population density (2000)	0.842***	0.830***	0.806***	0.773***	0.821***	0.857***
	Median house old		-0.249***				

(continued)

Demography	Population (2000)	0.949***	0.941***	0.932***	0.813***	0.876***	0.956***
	Registered voters (1998)	0.928***	0.909***	0.920***	0.804***	0.865***	0.969***
	Population with age under 5	0.168**	0.211**	0.158**	0.306*		
	Population with age over 65	-0.367***	-0.377***	-0.336***	-0.581***	-0.659***	
	Married couple with children		0.237***				0.661***
	Ratio of Asian	0.817***	0.815***	0.755***	0.677***	0.687***	0.756***
	Ratio of White						0.635**
	Ratio of Black						-0.641**
	Ratio of Hispanic	0.283***	0.323***	0.247***		0.555**	
	Ratio of renters	0.365***	0.209**	0.346***	0.424**		
	High school attainment ratio	-0.499***	-0.368***	-0.454***	-0.247***	-0.218***	
	College or above attainment ratio	0.617***	0.488***	0.566***	0.358***	0.311***	0.256***
Economy	Poverty rate (White)	-0.299***	-0.203***	-283***	-0.227***	-0.183**	-0.141*
	Poverty rate (Black)	-0.166**	-0.238***	-0.133*			
	Per capita Income ($,2000)	0.676***	0.531***	0.659***	0.621***	0.586**	0.854***
	Median income (White)	0.597***	0.460***	0.565***	0.347***	0.281***	0.255***
	Median income (Black)	0.451***	0.434***	0.403***	0.419***	0.362***	
	Median income (Hispanic)	0.200**	0.150*	0.192**	0.142*		
	Retail earning ($,2000)	0.939***	0.933***	0.942***	0.767***	0.836***	0.972***
	Per capita retail earning ($,2000)	0.626***	0.537***	0.583***	0.698***	0.846***	0.812***
	Retail sale ($,2000)	0.960***	0.944***	0.947***	0.804***	0.866***	0.964***
	Per capita retail sale ($, 2000)	0.493***	0.433***	0.443***	0.614***	0.673***	0.845***
Transportati-on	Interstate highway length	0.701***	0.406***	0.742***	0.444*	0.844***	
	Interstate highway (dummy)	0.345***	0.269***	0.314***	0.218***	0.183**	
	Highway length	0.781***	0.611***	0.786***	0.602***	0.757***	0.458*
	Railroad length	0.439***	0.269***	0.410***		0.438*	
	Commute by car ratio	0.355***	0.385***	0.303***	0.277***	0.234***	0.185**
	Commute using transit ratio	0.670***		0.715***			

Note: Only statistically significant variables are presented; *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level

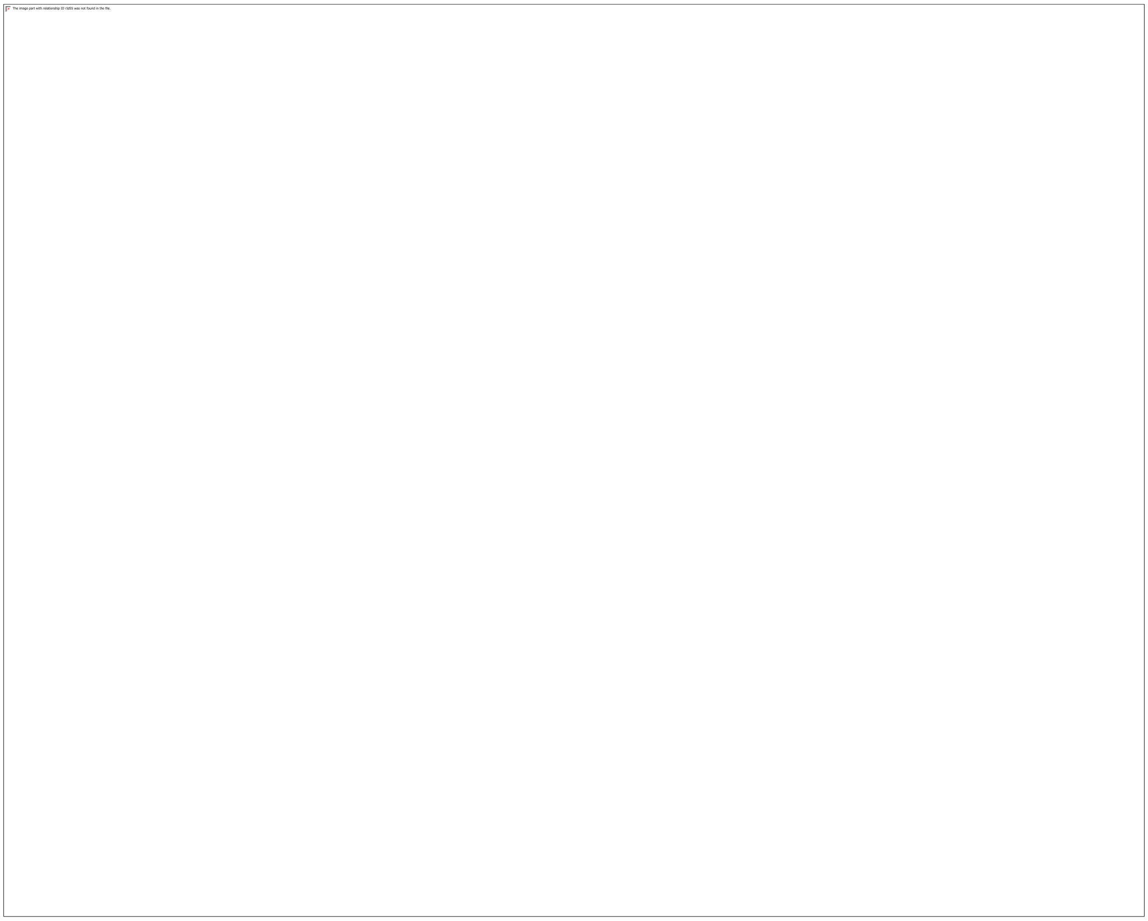
The results of correlation analysis also confirm the positive correlation between the amount of approved funds and the characteristics of metropolitan areas. For example, the dummy variable for metropolitan areas has correlation coefficients of 0.326 and 0.318 for transportation and education purposes, respectively, while the rural county dummy variable has negative correlation coefficients (-0.254 and -0.238).

Higher population, population density, ratios of Asian and Hispanic, and renters, which are typical characteristics of metropolitan counties, are positively and highly correlated with the total amount of approved funds through the 1% local sales tax. Also, economic variables, including income, retail earnings, and retail sales, which represent the condition of local tax bases, have highly positive correlations with the amount of approved funds.

6.5 Analysis of Main Factors Influencing Referenda Results

This section analyzes the factors that influenced the results of the SPLOST referenda.

Effects of Voter Turnout on Passage of Education and Transportation Referenda **-** Previous research has shown that from 1985 to 1997, lower voter turnout increased the likelihood of referenda passage. This suggests that referenda may be more likely to be approved during off-year special elections rather than in general election years [68]. Two types of analyses were conducted to test this result for 1998 to 2009. The first was a comparison of mean turnout for 'yes' and 'no' votes. The comparison was done for all votes as well as for metro, non-metro, transportation and education votes. For both 'yes' and 'no' votes the distribution of turnout was slightly skewed lower than the normal curve (see Figure 6.10). In all cases the mean turnout for 'no' votes was higher than that for 'yes' votes and the difference between the two ranged from 7.1 to 11.1 percentage points (see Table 6.13). This suggests that yes votes are more likely to occur in elections with lower turnout. However, the higher mean value for voter turnout in 'no' vote scenarios may be less informative due to the distribution of these data, in which a small n (n=43) and several outlying values on the upper end result in a nearly flat distribution curve (see Figure 6.10).



Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009.

Figure 6.10. Distribution of Voter Turnout for all Referendum Votes

Table 6.13. Mean Turnout for Referenda Votes

	Mean Turnout %					**Std. Deviation**	
	Yes	**No**	**Difference**	**Yes**	**No**	**Yes**	**No**
All Votes	20.2%	28.8%	8.6	678	41	15.6	18.2
Metro Votes	20.1%	27.6%	7.5	297	28	16.9	20.0
Non-Metro Votes	20.2%	31.3%	11.1	381	13	14.5	13.9
Transportation Votes	22.0%	32.7%	10.7	237	18	17.8	22.5
Education Votes	17.6%	24.7%	7.1	332	13	13.4	10.4

Source: Georgia Secretary of State, Special Purpose Local Option Sales Tax Election Results, 1998–2009

The second analysis utilized actual voter turnout data for each election. Voter registration data for each election was collected and used to create a turnout variable for each election.[4] Turnout rates for the data set were categorized into quartiles with categories of low (0.0177 - 0.2), mid (0.2 - 0.412), high (0.412 - 0.624) and very high (0.624 - 0.836). The turnout quartiles were used as the independent variable and analyzed using all referenda (n=719), metro referenda (n=325), non-metro referenda (n=394), education referenda (n=345) and transportation referenda (n=255). There was no significant effect of turnout on the full set of votes, the metro votes or on the education votes. However, there was a significant relationship when analyzing voter turnout and transportation referenda. Low- and mid-levels of voter turnout were related with higher rates of passage, but the correlation was very weak (Pearson's correlation coefficient = 0.197, p = 0.020). Additionally, there was a significant relationship when analyzing voter turnout and non-metro referenda, but the correlation was very weak (Pearson's correlation coefficient = 0.15, p = 0.032).

Voter turnout also was split between "low" (0.0177 - 0.2) and "high" (0.2 - 0.836) for analysis. There was no significant relationship for the categories metro, non-metro and transportation. There is a significant relationship, but a very weak correlation when looking at all votes versus turnout (Pearson's correlation coefficient = -0.085, p = 0.023). There is also a significant relationship, but very weak correlation when looking at education votes (Pearson's correlation coefficient = -0.12, p = 0.026).

Transportation Referenda - In 175 of the 721 elections between 1998 and 2009, transportation referenda were held in counties that had previously passed SPLOSTs. These cases were used to measure the impacts of education and other SPLOSTs on the adoption of

[4] Voter registration data were acquired from the Georgia Secretary of State's website http://sos.georgia.gov/elections/voter_registration/vrgraphs.htm . Last accessed June 2010. Total votes cast in the election were divided by number of registered voters to create a turnout ratio.

transportation SPLOSTs. Focusing on the impacts of school capital projects on transportation project finances, the expectation is that the longer taxpayers have to pay for education SPLOSTs the less they would be willing to support transportation projects through an additional SPLOST. Besides SPLOST-related variables, other analysis variables representing geography and the built environment, demography, economy, and transportation and infrastructure characteristics, were included in the regression analysis.

To measure spatial hierarchy and built environment characteristics, variables included the spatial size of counties (in square miles), population density, ratio of vacant housing units, the ratio of homeowners and dummy variables for metropolitan central county, metropolitan suburban county, and rural county. The extent of transportation infrastructure was represented by the length (miles) of interstate highways and total highway mileage for each county, and transportation behavior by the percentage of commuters using car and transit, respectively. It was expected that the likelihood of adopting transportation SPLOSTs is higher in metropolitan areas with higher population density where more infrastructure is needed.

Socio-demographic characteristics that may be related to voters' behavior were identified by variables such as age groups, e.g., 'under 5', 'between 5 and 17', and 'over 65'; race; and educational levels. Economic characteristics were specified by median income by race, retail sales, and tax exportation[5] representing the degree of the tax paid by non-residents. It was expected that counties with higher-income households and a large retail base that can export some of their sales taxes to non-residents are more likely to adopt SPLOSTs.

Table 6.14 presents the regression results for transportation SPLOSTs. The variables that are statistically significant are the remaining period (month) of SPLOSTs for miscellaneous

[5] Tax exportation was measured by per capita retail sales divided by per capita income (*5*)

Table 6.14. Main Factors Associated With Willingness to Adopt Transportation SPLOSTs (R^2: 0.4118)

Variables		Coefficient	t-value
	Intercept	0.9223	3.41***
SPLOST	Time from the adoption of educational purposes	0.0039	0.87
	Remaining period of existing transportation SPLOST (month)	-0.0007	-0.80
	Remaining period of existing education SPLOST (month)	-0.0008	-1.47
	Remaining period of existing capital outlay SPLOST (month)	-0.0016	-1.03
	Remaining period of existing miscellaneous SPLOST (month)	-0.0035	-1.93*
	Multi-issue referenda	0.0024	0.07
	Period of proposed SPLOST	-0.0003	-0.70
	Amount of proposed fund per capita	-0.0000	-0.55
	Turnout rate	-0.2698	-5.46***
Geography and built environment	Metropolitan central county (dummy)	-0.0503	-1.22
	Metropolitan suburban county (dummy)	0.0228	0.72
	Rural county (dummy)	0.0063	0.24
	Area (square miles)	-0.0001	-0.84
	Ratio of vacant housing units	-0.0904	-0.33
	Ratio of homeowners	-0.0391	-0.17
	Population density	-0.0001	-1.83*
Demography	Ratio of population aged 5 and under	1.0698	0.74
	Ratio of population aged between 5 and 17	-0.0978	-0.13
	Ratio of population aged 65 and over	0.3672	0.62
	Ratio of White	-0.1561	-1.43
	Ratio of Asian	0.7163	0.31
	Ratio of Hispanic	0.0217	.06
	Ratio of population with high school graduate	0.3048	0.38
	Ratio of population with college or more	0.4497	0.46
Economy	Median income (White)	0.0000	0.08
	Median income (Black)	-0.0000	-1.33
	Median income (Hispanic)	-0.0000	-0.72
	Retail sales ($)	0.0000	0.95
	Tax exportation	0.1046	1.58
Transportation and infrastructure	Existence of interstate highways	-0.0028	-0.09
	Interstate highway length	-0.0007	-0.41
	Highway length	0.0002	0.64
	Ratio of commuters by car	-0.1080	-0.23
	Ratio of commuters by transit	-2.9510	-0.45

Note: *** Significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level purposes, turnout rate and population density. Overall, the explanatory power of the model is moderate with an R-squared of 0.4118.

The length of time remaining on miscellaneous SPLOSTs has a negative coefficient (-0.0035) at the 10% significance level, indicating that tax payers are reluctant to adopt transportation SPLOSTs if they already have additional tax burdens for other purposes. Also, while not statistically significant, other SPLOST variables representing other purposes, such as education, capital outlay, and transportation have negative signs. The results make sense because the longer taxpayers have to pay for existing SPLOSTs, the less likely they may be to adopt a new transportation SPLOST.

The relation with voter turnout is also negative (-0.2698), consistent with Jung's results [67]. This means that the higher the voter turnout, the lower the likelihood that a transportation SPLOST referendum passes. However, unexpectedly, population density has an inverse relationship with the willingness to adopt transportation SPLOSTs. While the reason is not clear, it may be related to the relationship between the adoption of transportation SPLOSTs and the financial structure of metropolitan areas where the population density and capacity of infrastructure are relatively high. As discussed earlier, the willingness to adopt transportation SPLOSTs is less than in rural counties.

Education Referenda - Under the assumption that transportation SPLOSTs may affect education SPLOSTs as well, regression analysis was conducted with the percentage of voters who supported education referenda as a dependent variable. The election results for the 263 education purpose referenda that had pre-existing SPLOSTs were extracted from the total of 721 election results between 1998 and 2009. Similar to the results in the transportation SPLOST analysis, the variables of 'turnout rate' and 'population density' have a negative sign (see Table

6.15). For demographic characteristics, ‘population aged 5 and under’ has a positive effect on the support of educational SPLOSTs, while the variables for other age groups have negative effects and are statistically insignificant. As the length of most education SPLOSTs is 5 years, households with children under 5 may feel that current support for education SPLOSTs may pay dividends for them in the future. Only the ‘remaining period of educational SPLOSTs’ is statistically significant and negative, indicating that taxpayers are reluctant to adopt new educational SPLOSTs if there are already education SPLOSTs in place. The variable of ‘transportation SPLOSTs is also negative, but statistically not significant.

Based on the regression results from both the transportation and education SPLOSTs analyses, one can conclude that taxpayers are less likely to support SPLOSTs if they are already facing tax burdens from existing SPLOSTs. In particular, transportation SPLOSTs get less support from taxpayers if there is a SPLOST in effect regardless of its purpose, while voters are less willing to support education SPLOSTs if education SPLOSTs are still in place.

Table 6.15. Main Factors Associated With Willingness to Adopt Education SPLOSTs (R^2: 0.3967)

Variables		Coefficient	t-value
	Intercept	0.7960	4.54***
SPLOST	Time from the adoption of educational purposes	-0.0023	-0.99
	Remaining period of existing transportation SPLOST (month)	-0.0001	-0.21
	Remaining period of existing capital outlay SPLOST (month)	0.0003	0.62
	Remaining period of existing miscellaneous SPLOST (month)	0.0001	0.20
	Remaining period of existing education SPLOST (month)	-0.0014	-1.94*
	Period of proposed SPLOST	0.0007	0.57
	Amount of proposed fund per capita	0.0000	-0.22
	Turnout rate	-0.3478	-7.74***
Geography and built environment	Metropolitan central county (dummy)	0.0100	0.33
	Metropolitan suburban county (dummy)	0.0202	0.95
	Rural county (dummy)	0.0340	1.88*
	Area (square miles)	0.0000	-0.18
	Ratio of vacant housing units	0.0085	0.05
	Ratio of homeowners	0.1464	0.92
	Population density	-0.0001	-2.20**
Demography	Ratio of population aged 5 and under	1.8137	1.75*
	Ratio of population aged between 5 and 17	-0.2447	-0.49
	Ratio of population aged 65 and over	-0.2224	-0.58
	Ratio of White	-0.0155	-0.19
	Ratio of Asian	0.4545	0.28
	Ratio of Hispanic	-0.1877	-0.87
	Ratio of population with high school graduate	-0.0812	-0.16
	Ratio of population with college or more	0.8000	1.15
Economy	Median income (White)	-0.0000	-2.40**
	Median income (Black)	-0.0000	-0.44
	Median income (Hispanic)	0.0000	0.44
	Retail sales ($)	0.0000	1.34
	Tax exportation	-0.0589	-1.32
Transportation and infrastructure	Existence of interstate highways	0.0356	1.54
	Interstate highway length	-0.0016	-1.34
	Highway length	0.0002	0.96
	Ratio of commuters by car	0.1663	0.50
	Ratio of commuters by transit	1.5822	0.61

Note: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level

Chapter 7: CONCLUSIONS

From an institutional standpoint, this report concludes that there is a disconnect between school planning and land use planning in Georgia. Although some school districts actively coordinate with their local government, often coordination is not formalized, and therefore differs in terms of effectiveness. Even when school districts place staff on the planning and zoning commissions, often they are only asked for their input at the end of the process instead of at the beginning when a developer submits an application for a rezoning. This disconnect can result in two government agencies working against each other without knowing that one impacts the other.

While each agency may be fulfilling its goals and objectives from their viewpoint, from the perspective of the taxpayer, there is a conflict. Both county government and school districts are funded with taxpayer dollars, but are charged with different responsibilities and objectives. School planners are responsible for developing enrollment projections, facility plans, and building/renovating school facilities. County governments are charged with serving the interests of the community at-large by adopting land use plans and making decisions about the provision of infrastructure. Both school districts and county government have their own elected bodies that determine policy and make final decisions for their respective constituency. Each are given the authority to do what is necessary to carry out their mission by the state constitution. Each have funding mechanisms that allow them to determine budgets separately.

In areas where there is rapid growth and new development, school districts scramble to keep up with building facilities for students moving into their district. Often, residential development occurs years before significant commercial development and creates a lag in terms of sales tax revenue. It forces schools to make decisions quickly and based on where they can get the most "bang for the buck." In most cases this means siting schools on inexpensive land where a large school can be constructed and ensuring there is enough room to expand the school itself or even build another school on the same site in the future. School districts look to the state Department of Education to help fund capital improvements. In Georgia, although funding is available for existing school renovation, the funding match is higher for new construction. School districts usually recognize that new construction leads to the best return for their local match and choose to build new facilities more than renovate existing facilities.

Analysis of the data shows that in mature suburban counties, a school's attendance boundary shows some correlation with faster growth rates than the surrounding community (defined as the county as a whole). Although the causality of the growth rate cannot be absolutely determined, the statistical relationship between growth in the school attendance boundary and the school build date is moderate. This was determined through the chi-square statistic that measured independence between distance from school and whether or not the school was in place. The chi-square statistic suggested that these two variables were *not* independent. In mature urban, developing exurban, and rural counties, the results are unclear. In some cases, development occurred much more rapidly before the school was built, and other cases showed the growth increased after the school was built.

When the issue is examined from the perspective of distance from the newly built school, independent from the type of county, the results are somewhat clearer. In almost every case (except for close travel-time to the mature suburban elementary school and mid-range travel-time to the mature urban high school) the growth in the close and mid-range travel times increased in the years after the schools were built. This result may indicate that the construction of the new schools had some impact on the new development surrounding the school site.

Interview results from the school planners and school board members indicated the need for coordination in school planning. Although some school districts have a limited form of collaboration, many do not. School planners were frustrated with always being in a state of reaction to new housing development approved by the county. School planners agreed that increasing inter-governmental collaboration is the key to solving the problems of disjointed planning. Some districts attempt to collaborate with their corresponding local governments by placing representatives on the local planning and zoning commission. This can result in increased coordination of infrastructure provision and adherence to land use goals for the county. However, the development approval process can involve many steps and many times the planning and zoning commission in a locality may not be involved in the decision until the very end of the process, making it difficult to stop a development from occurring, or requiring there to be adequate provision of educational facilities before the development is approved.

This study also analyzed SPLOST referenda results in Georgia to better understand the propensity of voters to approve transportation and education sales taxes, and the implications of approval of one referendum on the approval of another. Since 1998, sales tax referenda have generally seen yearly pass rates greater than 80%. For the period 1998 to 2009, sales tax referenda passed statewide at a rate of 94% compared with 83.4% for the period 1985 to 1997. After the introduction of education SPLOSTs, the yearly number of non-education sales tax referenda on the ballot in Georgia dropped from around 38 per year to around 31 per year. However, the pass rates for non-education referenda went from 83.4% in 1985 to 1997 to 93% in the period from 1998 to 2009.

In analyzing the impacts of education and transportation referenda on one another, there are indications that there is some relationship between the two, but based on the current analysis the passage of either does not seem to negatively affect passage of the other. When looking statewide and controlling for metropolitan vs. non-metropolitan counties, education referenda are more likely to pass than are transportation referenda; however, the correlation was weak and both referenda pass at higher rates than did referenda in the 1985 to 1997 time period. When both transportation and education referenda were on the same ballot within a county, the transportation referenda passed and all but one education referenda passed. Based on the regression results from both the transportation and education SPLOSTs models, we are tempted to conclude that taxpayers are less likely to support SPLOSTs if there is a SPLOST already in place, but this effect is relatively weak given the high rates of passage even when previous SPLOSTs are still in effect. In particular, transportation SPLOSTs get less support from taxpayers if there is a SPLOST in effect. Results suggest that counties that pass transportation referenda will likely pass education referenda. Both education and transportation-related referenda passed at rates of 95.7% and 92.9%, respectively during the time period from 1998 to 2009.

Whether a county is metropolitan or non-metropolitan is significantly but weakly correlated with likelihood of passage, with non-metro measures being more likely to pass. Additionally, non-metropolitan (or rural) counties tend to have higher frequencies of passage and higher ratios of support for both transportation and education referenda. Additionally, higher population, population density, ratios of Asian and Hispanic, and renters, which are typical characteristics of metropolitan counties, are thought to be positively and highly correlated with the total amount of approved funds through the sales tax. Economic variables, including income, retail earnings, and retail sales, which represent the condition of local tax bases, typically have positive correlations.

Voter turnout in the 1998 to 2009 periods showed significant but weak correlation with all votes, transportation votes, education votes and non-metro votes having higher passage rates similar to the previous time period (1985 to 1997). The correlation with voter turnout is also negative, consistent with Jung's (*5*) results.

This study has shown that voters will vote to approve sales tax referenda associated with both transportation and schools. This does not necessarily mean that such voter behavior will continue into the future. However, it does suggest that both transportation infrastructure and education services remain important issues to local voters, so much so that they will tax themselves to support them.

APPENDIX A

INTERVIEW QUESTIONS

School Facility Planning Questionnaire
School Facility Planners

1) In general, how is school planning done in <*blank*> County?

2) What factors are evaluated when considering school location decisions?

   Growth patterns
   Transportation facilities
   Utility accessibility
   Existing neighborhood development
   Price of land
   Parcel size
   Accessibility to other community facilities (i.e. parks, libraries, rec center, etc.)

   Others (please specify)

3) Are recommendations about school locations made primarily by staff or by the school board members?

4) Are decisions about school locations made primarily by staff or by the school board members?

5) Is renovation considered a feasible option if an older school is located near existing residential development? Is this possible using the current Georgia Dept. of Education funding formulas?

6) Currently, the Georgia Department of Education requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high school facilities (plus one acre per 100 FTE). If there were less stringent acreage requirements from the Georgia Department of Education, would <*blank*> County Schools consider building multi-story buildings on smaller parcels?

7) Are developers ever required to provide a school site as part of the agreement for their approval to develop, or is that left completely up to the school district?

8) To your knowledge, has your county considered Adequate Public Facility Ordinances (APFOs) that would limit the development of housing subdivisions where there are not adequate public schools and infrastructure to support the development?

9) Is the lack of commercial tax revenue a significant hindrance for <*blank*> County schools in terms of obtaining funding for new school construction?

10) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?

School Facility Planning Questionnaire
School Board Members

1) What factors are evaluated when considering school location decisions?

Growth patterns
Transportation facilities
Utility accessibility
Existing neighborhood development
Price of land
Parcel size
Accessibility to other community facilities (i.e. parks, libraries, rec center, etc.)

Others (please specify)

2) When considering a site for a new school, does the board prefer to renovate existing schools or build new school schools? Does the Georgia Department of Education make adequate funding available for school renovation?

3) Currently, the Georgia Department of Education requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high school facilities (plus one acre per 100 FTE). If there were less stringent acreage requirements from the Georgia Department of Education, would the school board consider building multi-story buildings on smaller parcels?

4) Would the board be more likely to approve a school site further away from existing development and pay the higher transportation costs, or pay more for land an locate closer to existing development to save on transportation costs?

5) Has the school board ever considered working with the county to require developers to set aside parcels for neighborhood schools within their developments?

6) To your knowledge, has your county considered Adequate Public Facility Ordinances (APFOs) that would limit the development of housing subdivisions where there are not adequate public schools and infrastructure to support the development?

7) Is the lack of commercial tax revenue a significant hindrance for your school district in terms of obtaining funding for new school construction?

8) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?

School Facility Planning Questionnaire
Georgia Department of Education

1) How are current funding formulas designed with regard to school renovations and new construction?

2) When evaluating a school site, does DOE take into consideration the transportation impacts that a school's site will have or is that left primarily to the school district?

3) Many schools sites today are built apart from the current development. School districts cite a variety of reasons for locating beyond the fringe of development. Has the DOE ever considered a program that would incentivize school districts to build schools in already developed areas to avoid the added transportation costs to parents and the school district itself?

4) In the DOE Guide to Facility Site Selection there is recommendation for schools to be "appropriately located with respect to other schools and the population to be served." Does this definition allow school districts to build in areas with no development, but where development is expected to occur?

5) The Georgia Department of Education currently has minimum acreage requirements for school sites, however most school districts prefer larger tracts of land than the minimum. Has there ever been a consideration of a maximum site size to discourage excessive consumption of greenfield land?

6) If a school district decides to build on a smaller lot, does the DOE allow a waiver? What are the requirements to obtain a waiver?

7) What are the requirements of school districts and the DOE in terms of coordinating with local and state agencies (such as County Board of Commissioners, Regional Development Commission, and GDOT) regarding new school sites?

8) Does the DOE encourage school districts to coordinate with county government with regard to planning for growth and approving development plans? Has there been consideration to make that cooperation a regulatory mandate?

9) Are there any other policies you might recommend to integrate school planning with the land use planning process?

School Facility Planning Questionnaire
Georgia School Boards Association

1) According to the GSBA 2009 Legislative Positions section 1.C.9, the GSBA supports legislation that would require State and Local governmental planning offices to consider Local Boards of Educations' expansion plans as a separate planning and zoning factor in development decisions. Please expand on the issues related to zoning boards and school siting.

2) According to the GSBA 2009 Legislative Positions section 1.C.7, the GSBA calls for legislative action to provide waiver procedures for minimum acreage requirements. Does this request intend to encourage school districts to build on smaller sites?

3) How does the GSBA view the connection between land use and development and school siting decisions? Does the GSBA feel that school siting decisions should be made in cooperation with local land use planners?

4) Does the GSBA feel that the Georgia Department of Education allocates money fairly for the renovation of existing schools? If not, how should this policy be changed?

5) In section 1.C.11 of the GSBA 2009 Legislative Positions the GSBA recommends that there not be any redefinition of capital outlay for educational purposes. What does this mean?

6) In some other states, such as Florida, there is a requirement that development occur only when there are adequate public facilities (i.e. schools, sewer, roads, etc.) to support this development. Would GSBA support legislation that would require high growth areas to limit growth until the school districts catch up to the development?

7) Does the GSBA support school sites that are located in close proximity to existing development as a measure to help encourage smart growth principles?

8) Are there other policies or initiatives that the GSBA feels would better coordinate land use planning and school facility planning?

Question	Summary of Responses from Facility Planners
1) In general, how is school planning done in <*blank*> county?	Population is projected and the number of students is loaded into the existing instructional units. School sites are developed from a projection of where students will be in the next five years. The five-year plan is developed from these projections and submitted to GaDOE.
2) What factors are evaluated when considering school location decisions?	In almost every case, *growth patterns* were cited as the most important factor in school siting. Other important factors included utility accessibility, price of land, and parcel size. In almost every case, co-location with other community facilities was not an important issue. In the exurban districts, existing neighborhood development was not important because schools were typically not located within the neighborhoods.
3) Are recommendations about school locations made primarily by staff or by the school board members?	Unanimously all facility planners agreed that recommendations were made by the staff level facility planners.
4) Are decisions about school locations made primarily by staff or by the school board members?	Unanimously all facility planners agreed that final decisions were made by the school board. Some interviewees mentioned that on occasion politics does play a role in site selection, but often the staff recommendation is accepted by the board.
5) Is renovation considered a feasible option if an older school is located near existing residential development? Is this possible using the current Georgia DOE funding formulas?	Renovation will only be funded by GaDOE if the cost of renovation does not exceed 50% of replacement cost. Otherwise, renovation is usually considered for an option. This is particularly true in urban areas where land is less abundant. You can achieve more “bang for your buck” in building new facilities, but renovations are a viable option especially if the core capacity (cafeteria, kitchen, auditorium) allows for an expansion in classroom capacity.
6) Currently, the Georgia DOE requires a minimum acreage for a school site. If there were less stringent acreage requirements from GaDOE, would <*blank*> County Schools consider building multi-story buildings on smaller parcels?	Every school district said that these minimum requirements were not a hindrance to them because they desired larger sites than the minimum in almost every case. Schools with a need for a waiver found that GaDOE was willing to cooperate with them so the school could be located on a smaller site. Some schools had prototypical schools that were multi-story and others did not. Even some exurban districts built multi-story buildings so they could maximize parking space and athletic facility space.
7) Are developers ever required to provide a school site as part of the agreement for their approval to develop, or is that left completely up to the school district?	Georgia state law prohibits local governments from ‘requiring’ a developer to provide a site for a school. However, in many cases when the school district is at the table in the development approval process, developers are *encouraged* to donate land for a school. In all cases, these donated plots are on the edge of the development and not in the neighborhood itself. In many cases, the land has site issues needing extensive site work to be suitable for a school.
9) Is the lack of commercial tax revenue a significant hindrance for <*blank*> County schools in terms of obtaining funding for new school construction?	This issue was only significant in exurban and rural counties where the residential population is high and the commercial tax base is not enough to support facility construction through the ESPLOST. In these districts, it takes much longer to wait for sales tax revenue to come in and often school districts are forced to do their best by accepting donated parcels or saving on land costs by locating further away from major transportation facilities and existing development.
10) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?	While the responses differed significantly between those who believed that their school district did a good job of collaborating with county and city planning departments. Some counties knew that the level of collaboration was low and needed to be improved, but felt that because of political differences between the school board and the county commission there could not be staff communication between the two governing bodies.

APPENDIX B

STATE SITE SIZE REQUIREMENTS

Table B.1: Site Size Recommendations by State

State	Site Size Formula	Comments
Alabama	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 10 acres + 1 acre for each 100 students **High** – 15 acres + 1 acre for each 100 students	Recommendations only
Alaska	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students **High** – 30 acres + 1 acre for each 100 students	Recommendations only. Not formally regulated.
Arizona	**Elementary** – up to 8-18 acres **Middle** – up to 18-36 acres **High** – up to 30-70 acres	Apply for new construction only. Recommendations not listed in rules and policies.
Arkansas	No acreage recommendations	
California	**Elementary** – 10-18 acres **Middle** – 18-23 acres **High** – 33-53 acres	Alternative solutions to acreage recommendations are provided. Acreage is determined by number of students in the school.
Colorado	No acreage recommendations	
Connecticut	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 15 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	<u>Maximum</u> site sizes for state funding. Local funding may be used on smaller sites.
Delaware	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students **High** – 30 acres + 1 acre for each 100 students	<u>Minimum</u> recommendations only.
Florida	Guidelines do not address acreage guidelines	
Georgia	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 12 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	These are <u>minimums</u>. Waivers are possible if reduced acreage is considered appropriate. Large acreages are highly desirable.
Hawaii	**Elementary** – 12 acres **Middle** – 18 acres **High** – 50 acres	Recommendation for the "ideal" site
Idaho	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students over 500 **High** – 30 acres + 1 acre for each 100 students over 800	
Illinois	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 15 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	<u>Maximum</u> site sizes
Indiana	**Elementary** – 7 acres + 1 acre for every 100 students (max) **Middle** – 15 acres + 1 acre for each 100 students (min) **High** – 20 acres + 1 acre for each 100 students	
Iowa	No acreage recommendations	
Kansas	No acreage recommendations	
Kentucky	**Elementary** – 5 acres + 1 acre for every 100 students **Middle/High** – 10 acres + 1 acre for each 100 students	<u>Minimum</u> requirements

continued

State	Site Size Formula	Comments
Louisiana	No acreage recommendations	
Maine	**Elementary** – 5 (min) to 20 (max) + 1 acre/100 students **Middle** – 10 (min) to 25 (max) + 1 acre/100 students **High** – 15 (min) to 30 (max) + 1 acre/100 students	
Maryland	No acreage recommendations	
Massachusetts	No acreage recommendations	
Michigan	No acreage recommendations	
Minnesota	**Elementary** – 10-15 acres + 1 acre/100 students **Middle** – 25-35 acres + 1 acre/100 students **High** – 40-60 acres + 1 acre/100 students	Guidelines with allowances for urban/rural schools
Mississippi	**Elementary** – 5 acres + 1 acre per 100 students **High** – 15 acres + 1 acre per 100 students	Minimum acreage requirements for newly constructed schools. Waivers are available.
Missouri	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Guidelines only. State has no oversight on capital construction
Montana	No acreage recommendations	
Nebraska	No acreage recommendations	
Nevada	No acreage recommendations	
New Hampshire	**Elementary** – 5 acres + 1 acre per 100 students **Middle** – 10 acres + 1 acre per 100 students **High** – 15 acres + 1 acre per 100 students	Minimum requirements, although waivers are frequently granted.
New Jersey	No acreage recommendations	
New Mexico	No acreage recommendations	
New York	**Elementary** – 3 acres + 1 acre per 100 students **Secondary** – 10 acres + 1 acre per 100 students	Does not apply to New York City
North Carolina	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 15 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Recommended acreage
North Dakota	No acreage recommendations	
Ohio	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 35 acres + 1 acre per 100 students	Waivers granted at the discretion of the Ohio State Facilities Commission
Oklahoma	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	
Oregon	No acreage recommendations	
Pennsylvania	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 35 acres + 1 acre per 100 students	Only used for state funding. No minimum or maximum by state law or regulation.
Rhode Island	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Sites should be located whenever possible in proximity to other community facilities which would enhance the educational program.
South Carolina	Acreage requirements repealed in July 2003	

continued

State	Site Size Formula	Comments
South Dakota	No acreage recommendations	
Tennessee	No acreage recommendations	
Texas	No acreage recommendations	
Utah	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Size of site is more important than location. Inadequate size is a major factor in the obsolescence of educational facilities.
Vermont	No acreage recommendations	
Virginia	**Elementary** – 4 acres + 1 acre per 100 students **Middle/High** – 10 acres + 1 acre per 100 students	Minimum recommendations. Local districts may set higher standards. Urban areas may seek waivers for smaller sites.
Washington	5 acres + 1 acre per 100 students plus additional 5 acres if the school contains any grade above sixth	
West Virginia	**Elementary** – 5 acres + 1 acre per 100 students over 240 **Middle** – 11 acres + 1 acre per 100 students over 600 **High** – 15 acres + 1 acre per 100 students over 800	Urban schools should be urban in scale. The WV BOE must approve all sites not meeting minimum standards.
Wisconsin	No acreage recommendations	
Wyoming	**Elementary** – 4 acres + 1 acre per 100 students **Middle** – 10 acres + 1 acre per 100 students **High** – 20-30 acres + 1 acre per 100 students	Minimum size requirements. Districts shall refrain from addition to older schools that occupy a site less than 50% of the currently recommended site sizes.

Source: Weihs, Janell. "School Site Size - How Many Acres Are Necessary?" Scottsdale, AZ: Council of Educational Facility Planners International, 2003.

APPENDIX C

DETAILED STATISTICAL DATA

Elementary School: County A

Table C.1 – County A, Elementary School, Total Structures

Table C.2 – County A, Elementary School, Cross-Tabulation Summary

Table C.3 – County A, Elementary School, Pearson Chi-Square

Table C.4 – County A, Elementary School, Cramer's V

<u>High School: County A</u>

Table C.5 – County A, High School, Total Structures

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Table C.6 – County A, High School, Cross-Tabulation Summary

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Table C.7 – County A, High School, Pearson Chi-Square

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Table C.8 – County A, High School, Cramer's V

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Elementary School: County B

Table C.9 – County B, Elementary School, Total Structures

Table C.10 – County B, Elementary School, Cross Tabulation Summary

Table C.11 – County B, Elementary School, Pearson Chi-Square

Table C.12 – County B, Elementary School, Cramer's V

High School, County B

Table C.13 – County B, High School, Total Structures

Table C.14 – County B, High School, Cross Tabulation Summary

Table C.15 – County B, High School, Pearson Chi-Square

Table C.16 – County B, High School, Cramer's V

Elementary School, County C

Table C.17 – County C, Elementary School, Total Structures

Table C.18 – County C, Elementary School, Cross Tabulation Summary

Table C.19 – County C, Elementary School, Pearson Chi-Square

Table C.20 – County C, Elementary School, Cramer's V

High School, County C

Table C.21 – County C, High School, Total Structures

Table C.22 – County C, High School, Cross Tabulation Summary

Table C.23 – County C, High School, Pearson Chi-Square

Table C.24 – County C, High School, Cramer's V

Elementary School, County D

Table C.25 – County D, Elementary School, Total Structures

Table C.26 – County D, Elementary School, Cross Tabulation

Table C.27 – County D, Elementary School, Pearson Chi-Square

Table C.28 – County D, Elementary School, Cramer's V

High School, County D

Table C.29 – County D, High School, Total Structures

Table C.30 – County D, High School, Cross Tabulation Summary

Table C.31 – County D, High School, Pearson Chi-Square

Table C.32 – County D, High School, Cramer's V

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